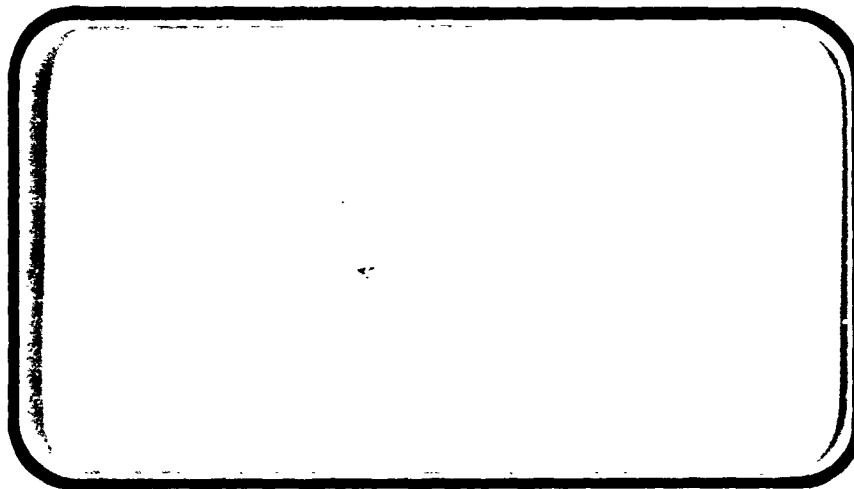


NASA

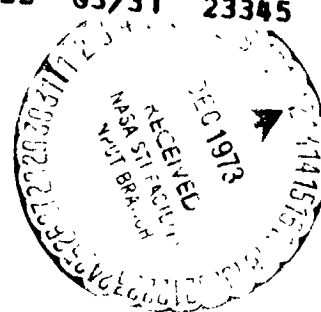
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



(NASA-CR-128787) STABILITY AND CONTROL
CHARACTERISTICS OF A LANGLEY CONCEPT
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SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA Management services

SPACE DIVISION



**CHRYSLER
CORPORATION**

October, 1973

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NASA CR -128,787

STABILITY AND CONTROL CHARACTERISTICS
OF A LANGLEY CONCEPT SPACE SHUTTLE ORBITER (LO-100)
AT LOW SUBSONIC SPEEDS

By

Bernard Spencer, Jr., NASA/LaRC

Prepared under NASA Contract Number NAS9-13247

by

Data Management Services
Chrysler Corporation Space Division
New Orleans, La. 70189

for

Engineering Analysis Division
Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number: LaRC LTPT 141
NASA Series No.: LA23
Occupancy Hours: 32 Hrs.
Test Date: July 31 - August 3, 1973

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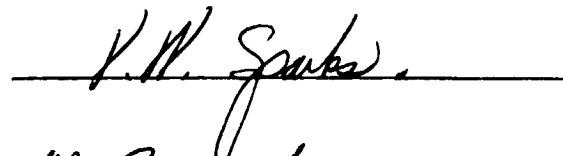
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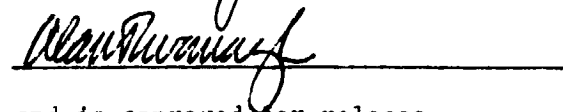
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This document has been prepared by:

V. W. Sparks
Liaison Operations

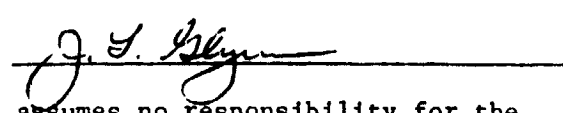


Alan Kavanaugh
Data Operations



This document has been reviewed and is approved for release.

For N.D. Kemp
Data Management Services



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STABILITY AND CONTROL CHARACTERISTICS OF A
LANGLEY CONCEPT SPACE SHUTTLE ORBITER
(LO-100) AT LOW SUBSONIC SPEEDS

By

Bernard Spencer, Jr.*

SUMMARY

An experimental aerodynamic investigation was conducted on a 0.01 scale model of a Langley concept space shuttle orbiter (LO-100) in the Langley Low Turbulence Pressure Tunnel at a Mach number of 0.25 and at a Reynolds number of 5.4×10^6 per foot. The angle of attack was varied from about -2° to 24° at 0° and 5° sideslip.

The configuration was tested at elevon settings of 0° , -5° , -10° , and -15° for a body base flap setting of 0° and at 0° , -10° , and -15° for a body base flap setting of -18° . The effect of rudder flare angle was obtained using 0° , 20° , and 40° flare settings.

*NASA/LaRC

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PLOTTED COEFFICIENTS SCHEDULE

(A) CA, CPB, CPC1, CPC2, CN versus ALPHA

CN versus CLM
CL versus ALPHA
CL versus CLM
CLM, L/D, CD versus ALPHA
CD versus CL

(B) DCY/DB, DCYNDB, DCBLDB versus ALPHA CY, CYN, CBL versus ALPHA

NOMENCLATURE
General

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
a		speed of sound; m/sec, ft/sec
C _p	CP	pressure coefficient; $(P_1 - P_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; N/m ² , psf
q	Q(NSM) Q(PSF)	dynamic pressure; $1/2\rho V^2$, N/m ² , psf
RN/L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
ϕ	PHI	angle of roll, degrees
ρ		mass density; kg/m ³ , slugs/ft ³

Reference & C.G. Definitions

A _b		base area; m ² , ft ²
b	BREF	wing span or reference span; m, ft
c.g.		center of gravity
$\frac{l}{c}$ _{REF}	LREF	reference length or wing mean aerodynamic chord; m, ft
S	SREF	wing area or reference area; m ² , ft ²
	MRP	moment reference point
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis

SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream

NOMENCLATURE (Continued)

Body-Axis System

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
C_N	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C_A	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_{A_b}	CAB	base-force coefficient; $\frac{\text{base force}}{qS}$ $-A_b(P_b - P_\infty)/qS$
C_{A_f}	CAF	forebody axial force coefficient, $C_A - C_{A_b}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_{REF}}$
C_n	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qSb}$
C_l	CL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qSb}$

Stability-Axis System

C_L	CL	lift coefficient; $\frac{\text{lift}}{qS}$
C_D	CD	drag coefficient; $\frac{\text{drag}}{qS}$
C_{D_b}	CDB	base-drag coefficient; $\frac{\text{base drag}}{qS}$
C_{D_f}	CDF	forebody drag coefficient; $C_D - C_{D_b}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_{REF}}$
C_n	CLN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qSb}$
C_l	CSL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qSb}$
L/D	L/D	lift-to-drag ratio; C_L/C_D

NOMENCLATURE (Continued)

ADDITIONS TO STANDARD LIST

<u>SYMBOL</u>	<u>PLOT SYMBOL</u>	<u>DEFINITION</u>
C_{PB}	CPB	pressure coefficient at base
C_{PC1}	CPC1	pressure coefficient in balance cavity at location #1
C_{PC2}	CPC2	pressure coefficient in balance cavity at location #2
$C_{Y\beta}$	DCY/DB	side force coefficient derivative with respect to beta. Algebraic difference of the side force coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; per degree.
$C_{n\beta}$	DCYNDB	yawing moment coefficient derivative with respect to beta. Algebraic difference of the yawing moment coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; body axis system; per degree.
$C_{l\beta}$	DCBLDB	rolling moment coefficient derivative with respect to beta. Algebraic difference of the rolling moment coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; body axis system; per degree.
δ_e	ELEVTR	elevator deflection, degrees; determined by: $(\delta_{eL} + \delta_{eR})/2$
δ_a	AILRON	aileron deflection, degrees; determined by: $(\delta_{eL} - \delta_{eR})/2$
δ_{BF}	BDFLAP	body flap deflection, degrees; positive direction trailing edge down.
δ_{RF}	RUDFLR	rudder flare, split rudder deflection angle, left split rudder trailing edge left and right split rudder trailing edge right, $\delta_{RF} = (\delta_{RL} + \delta_{RR})/2$, positive deflection; degrees.

DESIGN PHILOSOPHY

During the course of phase B activity prior to the selection of a prime contractor to develop and build the Space Shuttle, Langley Research Center undertook in-house design of several orbiter configurations which would meet mission qualifications as specified in the request-for-proposals. The objectives of these in-house efforts were to design a configuration meeting mission requirements, based on previous experience in subsonic/hypersonic spacecraft development, and gain additional knowledge in a particular design philosophy in order to better evaluate the various proposed orbiter concepts. The present paper presents aerodynamic results obtained on one conceptual design developed by Space Systems Division.

The basic mission requirements to be satisfied were maximum subsonic angle of attack for landing of 18° with a minimum landing speed of 150 knots for a recovery weight of 170,000 lbs. payload out and 210,000 payload in. Hypersonic requirements specified stable trim angle-of-attack range from about 18° to 40° encompassing conditions satisfying high-to-low cross range missions, and a maximum lift-to-drag ratio near 2.0.

The basic wing selected for the present design has 33.2° leading-edge sweep, unswept trailing edge, taper ratio of 0.15, aspect ratio of 2.212, NACA 0006 airfoil section at the theoretical root, NACA 0012 airfoil section at the tip with 1° of incidence in the root section and -4° incidence at the tip. This particular planform was selected from subsonic considerations since previous experience indicated linearity in lift-curve slope to angles of attack near 20° (ref. 1) and linearity in

pitch to high lift (ref. 2). Although wings of lesser sweep produce higher low-angle lift-curve-slope, earlier stall occurs resulting in large lift losses at the specified angle for landing (i.e. $\alpha \approx 18^\circ$) and resultantly large pitch-down which would require high control deflections for trim and additional losses in lift. Estimated trimmed lift for the present design, employing the methods of reference 3, results in a required wing area of 3471 square feet for a landing weight of 210,000 lbs. Longitudinal location of the wing is estimated to produce a 2 percent static margin at subsonic speeds and a basic stable trim angle of about 18° at hypersonic speeds for an estimated forward center of gravity 66 percent of body length.

The fuselage of the present concept has a maximum cross sectional area somewhat in excess of the minimum required to house the 15 foot diameter payload bay. This was done in order to allow for some body base boat tailing to reduce subsonic base drag and improve aerodynamic performance. The fuselage forebody incorporates an upswept nose (positive camber) to produce near zero or positive pitch at zero angle of attack at hypersonic speeds. A body base flap is also included to shield the main engine during entry and also as a hypersonic control device. Overall body length (excluding base flap) is 1350 inches.

CONFIGURATIONS INVESTIGATED

These tests utilized a 0.01 scale model of the LaRC LO-100 orbiter. The model components tested are listed below. Pertinent dimensional information for these components is given in table III. Table II delineates

the various configurations these components were tested in during this investigation.

B - Body
E - Elevon
FB - Body Flap
V - Vertical Tail
W1 - Wing

TEST FACILITY DESCRIPTION

The tests were conducted in the Langley low turbulence pressure tunnel which is a variable-pressure, single return facility with a closed rectangular test section that is 0.914 meter (3.00 ft.) wide and 2.290 meter (7.50 ft.) high. The tunnel can accommodate tests in air at low subsonic Mach numbers and at a Reynolds number per unit length up to about 49.2×10^6 per meter (15.0×10^6 per foot).

TEST CONDITIONS

Tunnel conditions existing during the test are summarized in Table I (Test Conditions). The model was sting supported and the aerodynamic forces and moments were measured by an internally mounted six-component strain gage balance. Model angle of attack was varied from about -2° up to 24° for angles of sideslip of 0° and 5° , and corrected for the effects of sting and balance bending under load.

DATA REDUCTION

Aerodynamic forces and moments have been reduced to coefficient form based on the following reference values:

S_{REF} = wing theoretical planform area = 0.3471 ft.²

l_{REF} = fuselage length = 13.50 inches

b_{REF} = wing reference span = 10.5151 inches

Moments have been reduced about a center of gravity located at 66 percent of the fuselage length. This point is:

Fus. Sta. = 8.910 inches

Water line = 0 (centerline payload bay)

Body line = 0.0

Base pressure coefficients are presented for both the base and cavity regions. Normal tunnel blockage and lift interference effects have been applied to the data. No transition strips were used during the test. Drag data presented herein represents gross drag in that base and cavity pressures have not been adjusted to free stream conditions.

REFERENCES

1. Graham, David: The Low Speed Lift and Drag Characteristics of Airplane Models Having Triangular or Modified Triangular Wings. NACA RMA-53D14, June 15, 1953.
2. Spreemann, Kenneth P.: Design Guide for Pitch-Up Evaluation and Investigation at High Subsonic Speeds of Possible Limitations Due to Wing-Aspect-Ratio Variations. NASA TMX-26, 1959.
3. Spencer, Bernard, Jr.: A Simplified Method for Estimating Subsonic Lift Curve Slope at Low Angles of Attack for Irregular Planform Wings. NASA TMX-525, May 1961.

TABLE I.

[illegible]

TABLE II.

[illegible]

TABLE III.

DIMENSIONAL DATA

MODEL COMPONENT: BODY - B

GENERAL DESCRIPTION: _____

DRAWING NUMBER _____

DIMENSION:

FULL SCALE

MODEL SCALE

In. or In²

Length

1350

Max Width

125.55

Max Depth

231.0

Fineness Ratio

Area

Max Cross-Sectional

Planform

Wetted

Base

TABLE III. (Continued)

MODEL COMPONENT: ELEVON

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

DIMENSIONS:

FULL-SCALE

MODEL SCALE

Area

48,751.2

Span (equivalent)

399.6

Inb'd equivalent chord

122.0

Outb'd equivalent chord

122.0

Ratio movable surface chord/
total surface chord

At Inb'd equiv. chord

- - - -

At Outb'd equiv. chord

- - - -

Sweep Back Angles, degrees

Leading Edge

0°

Tailing Edge

0°

Hingeline

0°

Area Moment (Normal to hinge line)

TABLE III. (Concluded)

MODEL COMPONENT: BODY FLAP - FB

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> <u>in. or in.²</u>	<u>MODEL SCALE</u>
Area	<u>10,000</u>	_____
Span (equivalent)	<u>252.0</u>	_____
Inb'd equivalent chord	<u>79.65</u>	_____
Outb'd equivalent chord	<u>79.65</u>	_____
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>- - -</u>	_____
At Outb'd equiv. chord	<u>- - -</u>	_____
Sweep Back Angles, degrees		
Leading Edge	<u>- - -</u>	_____
Tailing Edge	<u>- - -</u>	_____
Hingeline	<u>- - -</u>	_____
Area Moment (Normal to hinge line)	<u>- - -</u>	_____

TABLE III. (Continued)

MODEL COMPONENT: VERTICAL TAIL - VGENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

DIMENSIONS:FULL-SCALE
in. or in.²MODEL SCALETOTAL DATA

Area

Planform

69,836

Wetted

- - - -

Span (equivalent)

369.2

Aspect Ratio

Rate of Taper

Taper Ratio

Dihedral Angle, degrees

Incidence Angle, degrees

Aerodynamic Twist, degrees

Toe-In Angle

Cant Angle

Sweep Back Angles, degrees

Leading Edge

45°

Trailing Edge

25°

0.25 Element Line

Chords:

Root (Wing Sta. 0.0)

288.0

Tip, (equivalent)

90.35

MAC

Fus. Sta. of .25 MAC

W.P. of .25 MAC

B.L. of .25 MAC

Airfoil Section

Root

NACA

0012-64

Tip

NACA

0012-64

EXPOSED DATA

Area

Span, (equivalent)

Aspect Ratio

Taper Ratio

Chords

Root

Tip

MAC

Fus. Sta. of .25 MAC

W.P. of .25 MAC

B.L. of .25 MAC

TABLE III. (Continued)

MODEL COMPONENT: WING - S1

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

DIMENSIONS:	FULL-SCALE in. or in. ²	MODEL SCALE
-------------	---------------------------------------	-------------

TOTAL DATA

Area		
Planform	499,824	
Wetted	---	
Span (equivalent)	1051.512	
Aspect Ratio	2.212	
Rate of Taper	---	
Taper Ratio	.15	
Dihedral Angle, degrees	7.0°	
Incidence Angle, degrees	+1° root, -4° tip	
Aerodynamic Twist, degrees	" "	
Toe-In Angle	---	
Cant Angle	---	
Sweep Back Angles, degrees		
Leading Edge	53.2°	
Trailing Edge	0.0°	
0.25 Element Line	---	
Chords:		
Root (Wing Sta. 0.0)	826.8	
Tip, (equivalent)	124.02	
MAC	561.984	
Fus. Sta. of .25 MAC	928.508	
W.P. of .25 MAC	---	
B.L. of .25 MAC	---	
Airfoil Section		
Root	NACA 0006-64	
Tip	NACA 0012-64	

EXPOSED DATA

Area		
Span, (equivalent)		
Aspect Ratio		
Taper Ratio		
Chords		
Root		
Tip		
MAC		
Fus. Sta. of .25 MAC		
W.P. of .25 MAC		
B.L. of .25 MAC		

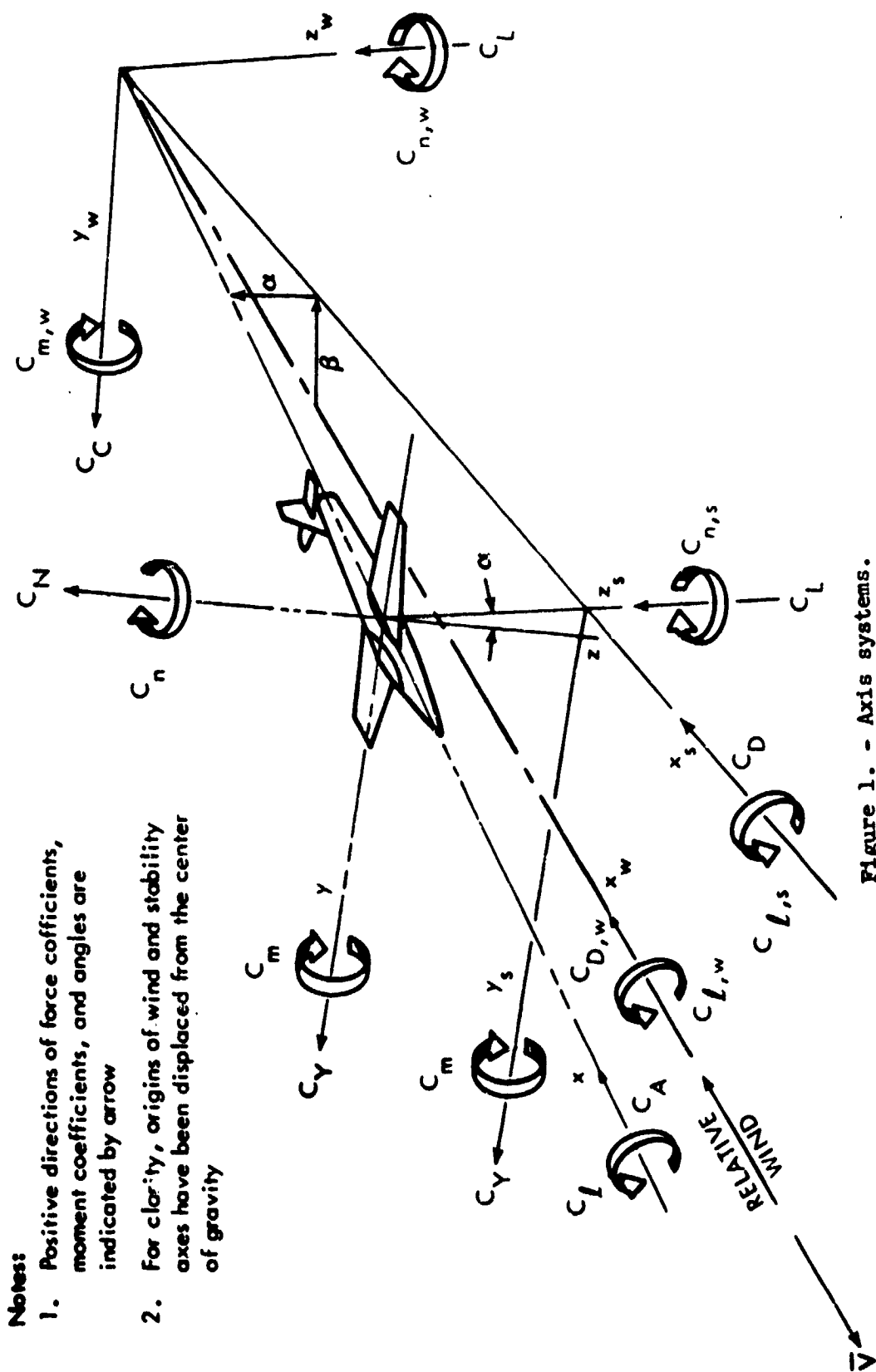


Figure 1. - Axis systems.

- Notes:
1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrow
 2. For clarity, origins of wind and stability axes have been displaced from the center of gravity

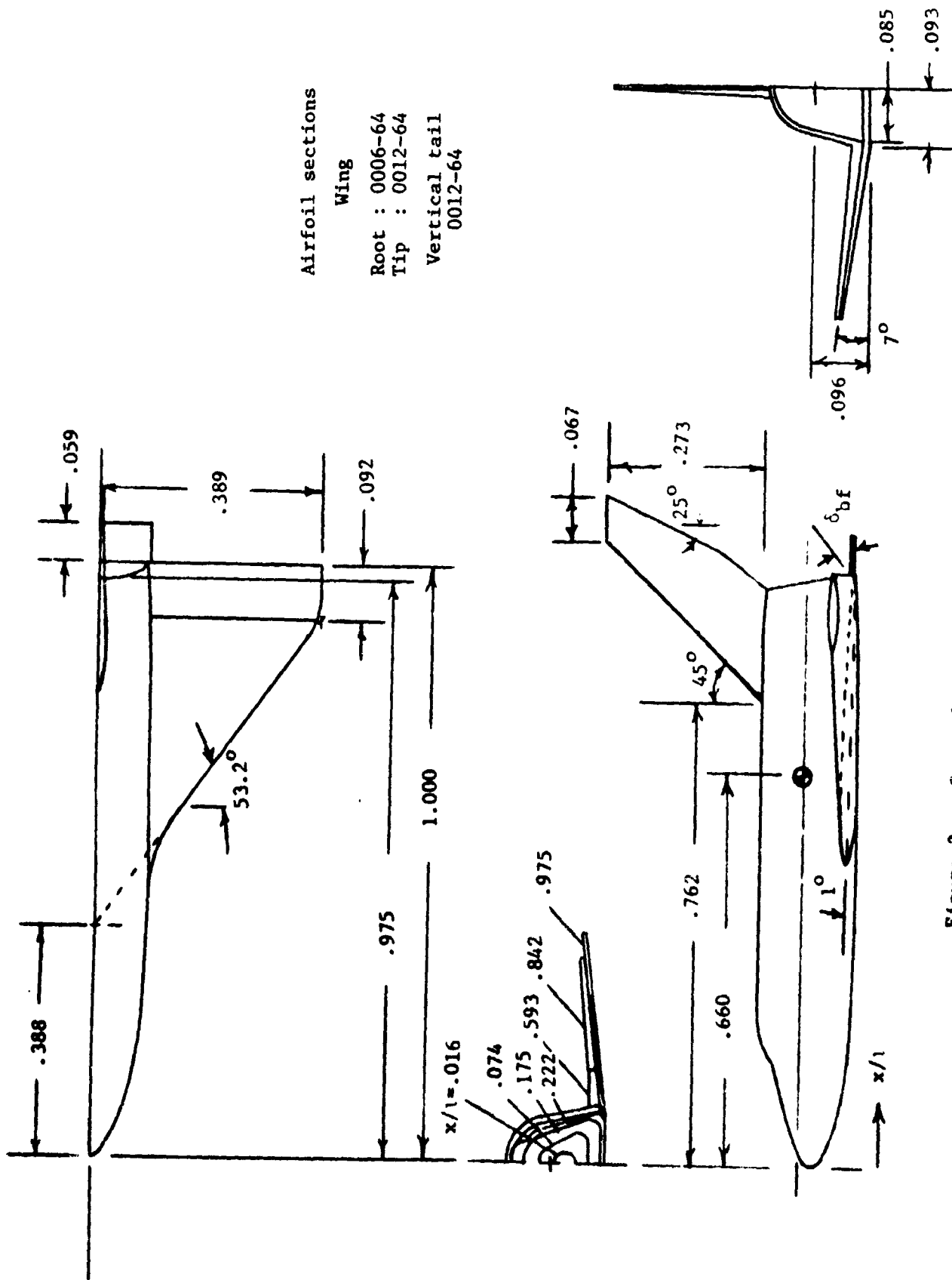
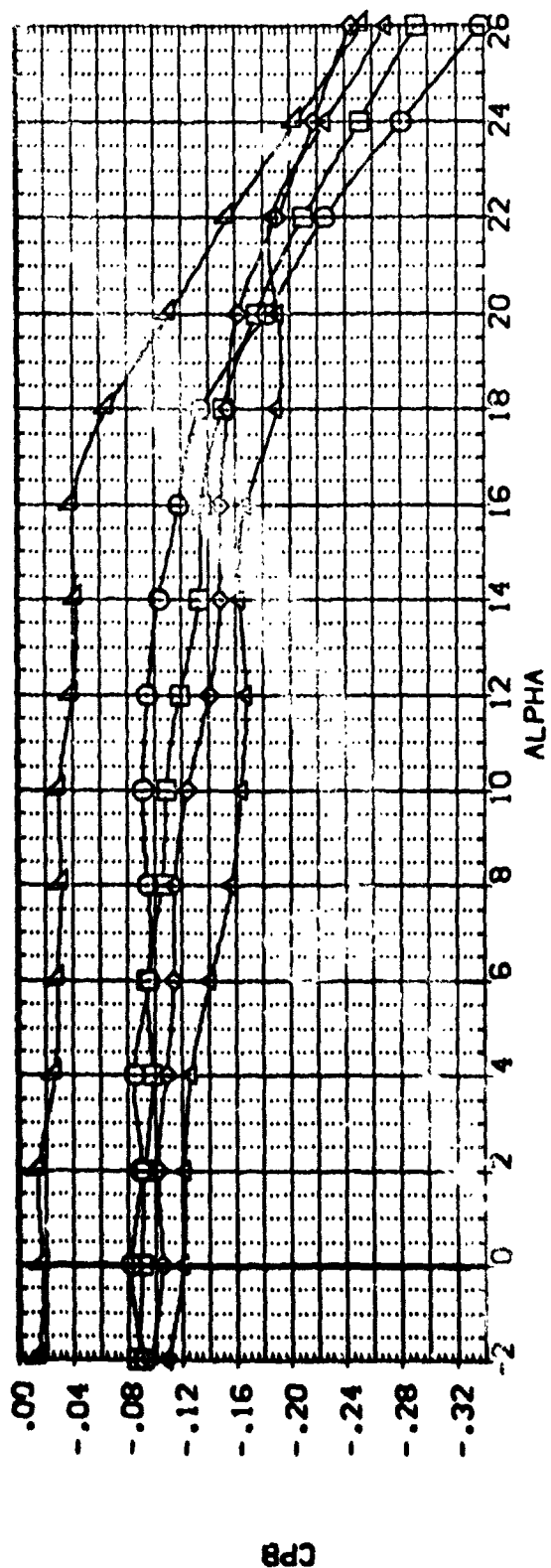
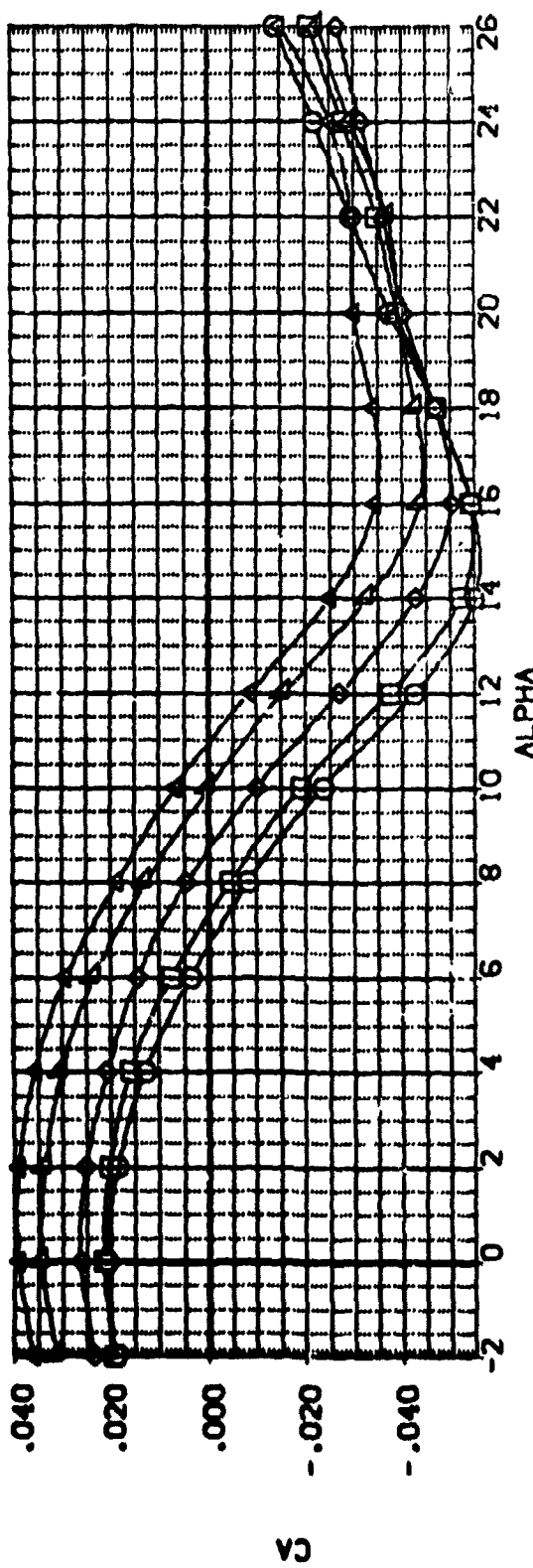


Figure 2. - General arrangement of LO-100 orbiter.

DATA FIGURES

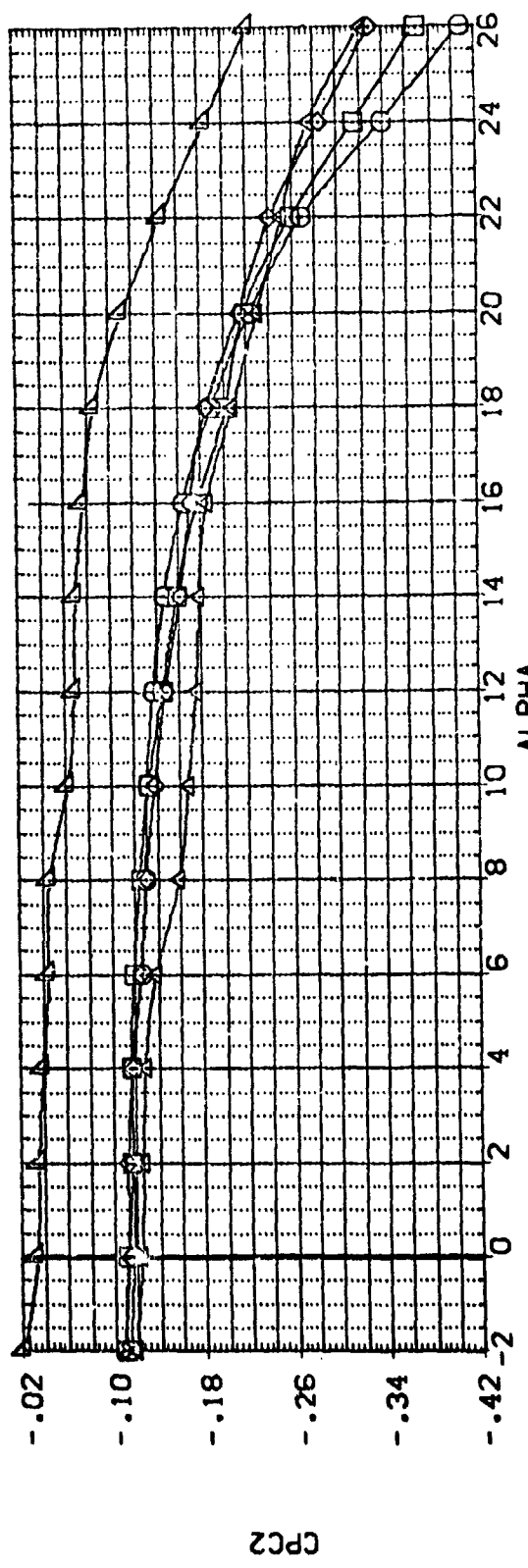
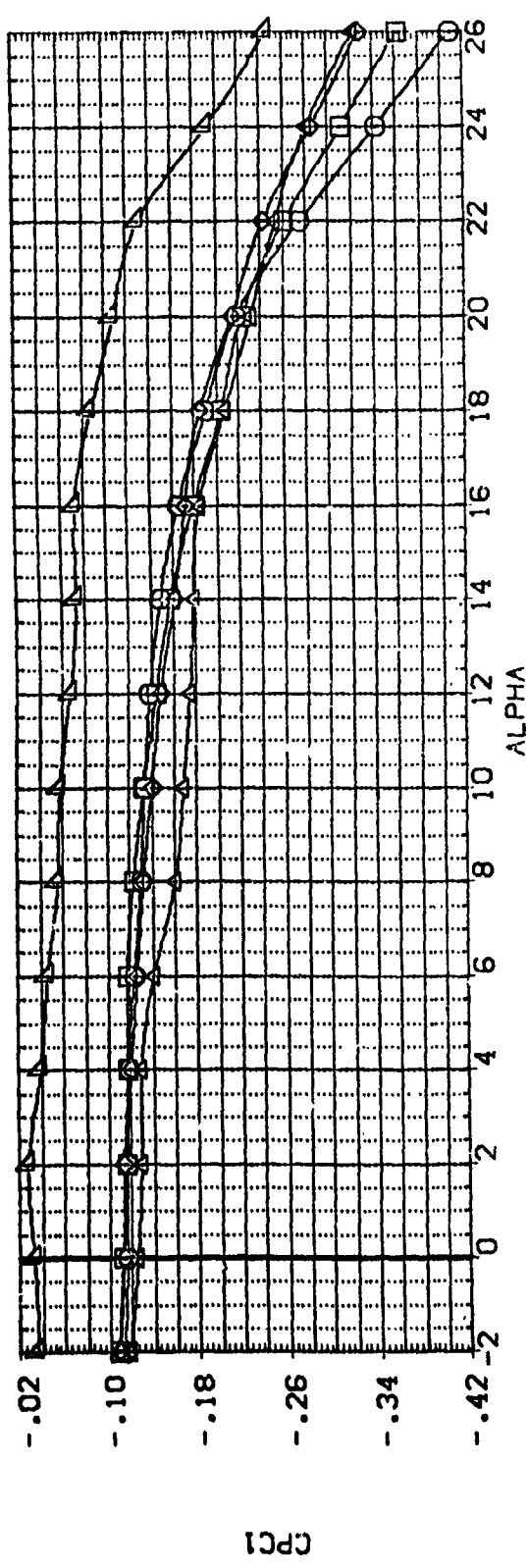
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(PR002)	LA-23(LTPT-14)ILARC LO-100 ONS/TER (SV/VFB)	-3.000	.000	.000	.000	IREF 13.5000 13.500
(PR003)	LA-23(LTPT-14)ILARC LO-100 ONS/TER (SV/VFB)	-10.000	.000	.000	.000	BREF 10.5151 10.515
(PR004)	LA-23(LTPT-14)ILARC LO-100 ONS/TER (SV/VFB)	-15.000	.000	.000	.000	YREF 8.9100 8.910
(PR005)	LA-23(LTPT-14)ILARC LO-100 ONS/TER (SV/VFB)		.000	-18.000	.000	ZREF .0000 0.000
						SCALE .0100 1.000



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

(AJRN/L = 5.40

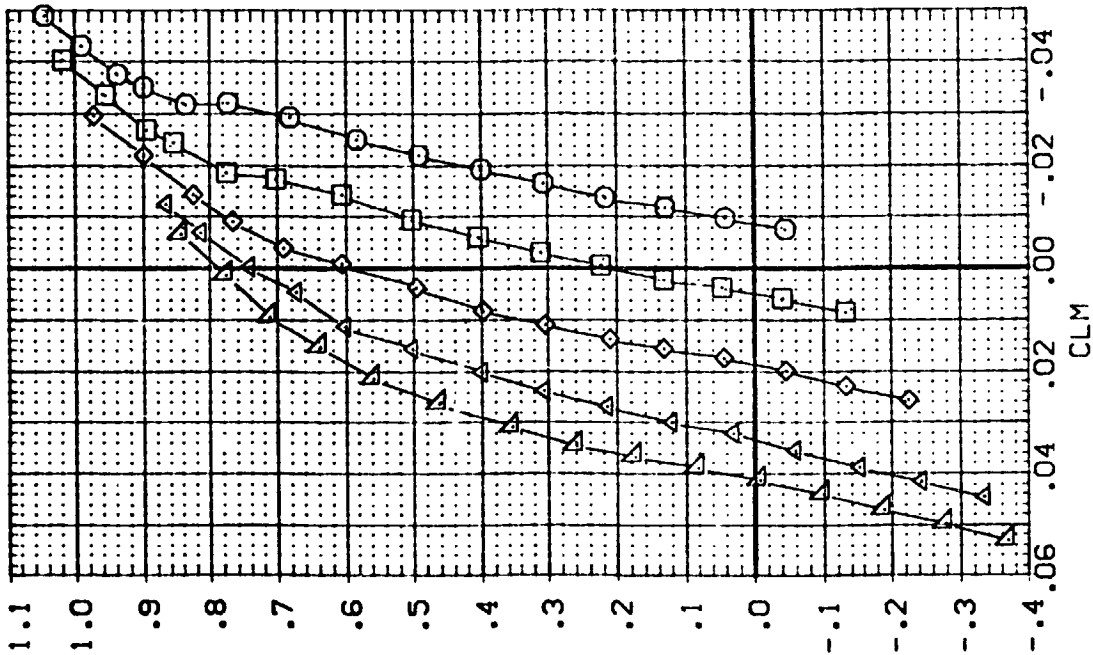
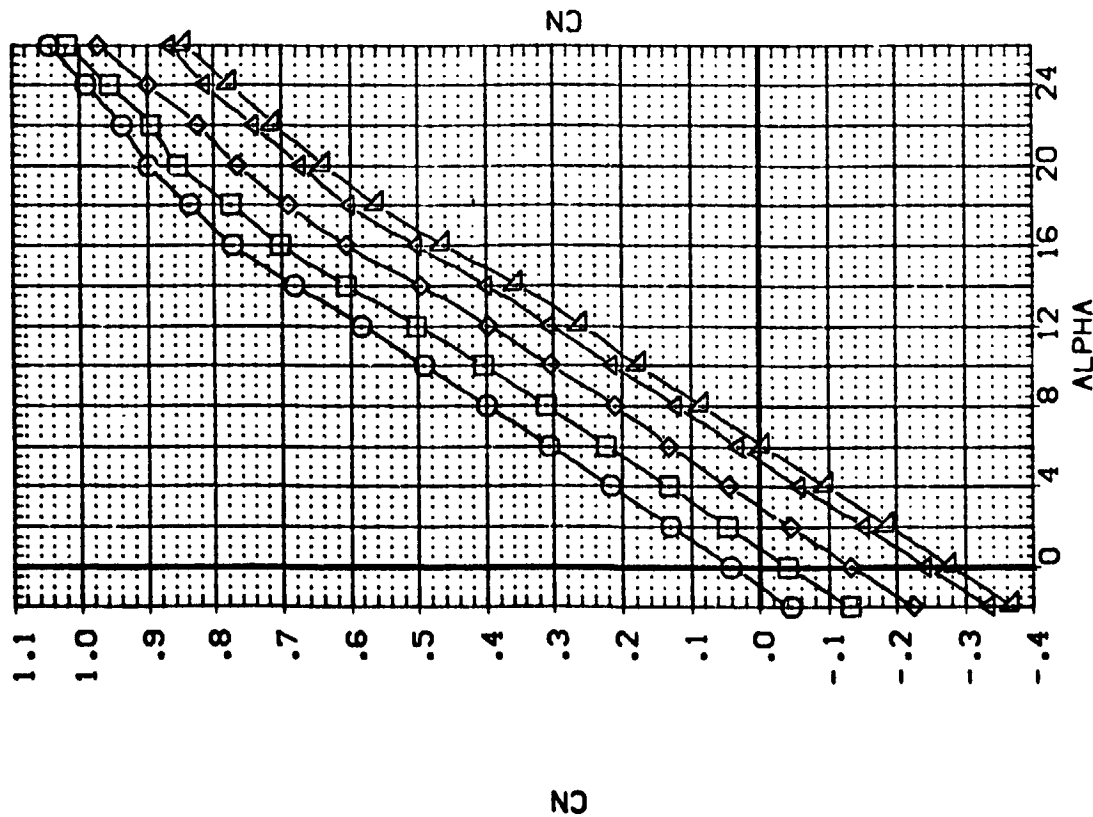
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{FPJ002}	LA-23(LTPT-14)3LARC LG-100 ORBITER (BV1VFB)	.000	.000	.000	.000	13.5000 INC.ES
{FPJ003}	LA-23(LTPT-14)3LARC LG-100 ORBITER (BV1VFB)	-5.000	.000	.000	.000	10.5151 INC.ES
{FPJ004}	LA-23(LTPT-14)3LARC LG-100 ORBITER (BV1VFB)	-10.000	.000	.000	.000	8.9100 INC.ES
{FPJ005}	LA-23(LTPT-14)3LARC LG-100 ORBITER (BV1VFB)	-15.000	.000	-18.000	.000	.0000 INC.ES
					ZMRP	.0000 INC.ES
					SCALE	.0170 SCALE



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

(AJRN/L = 5.40

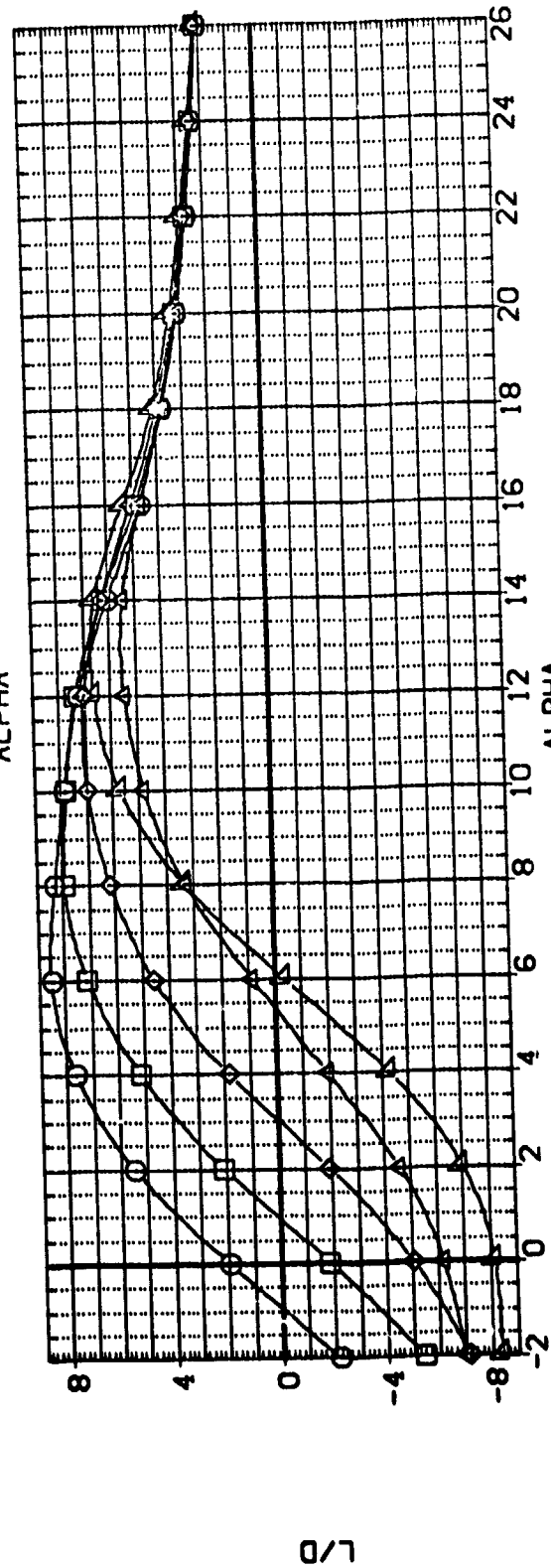
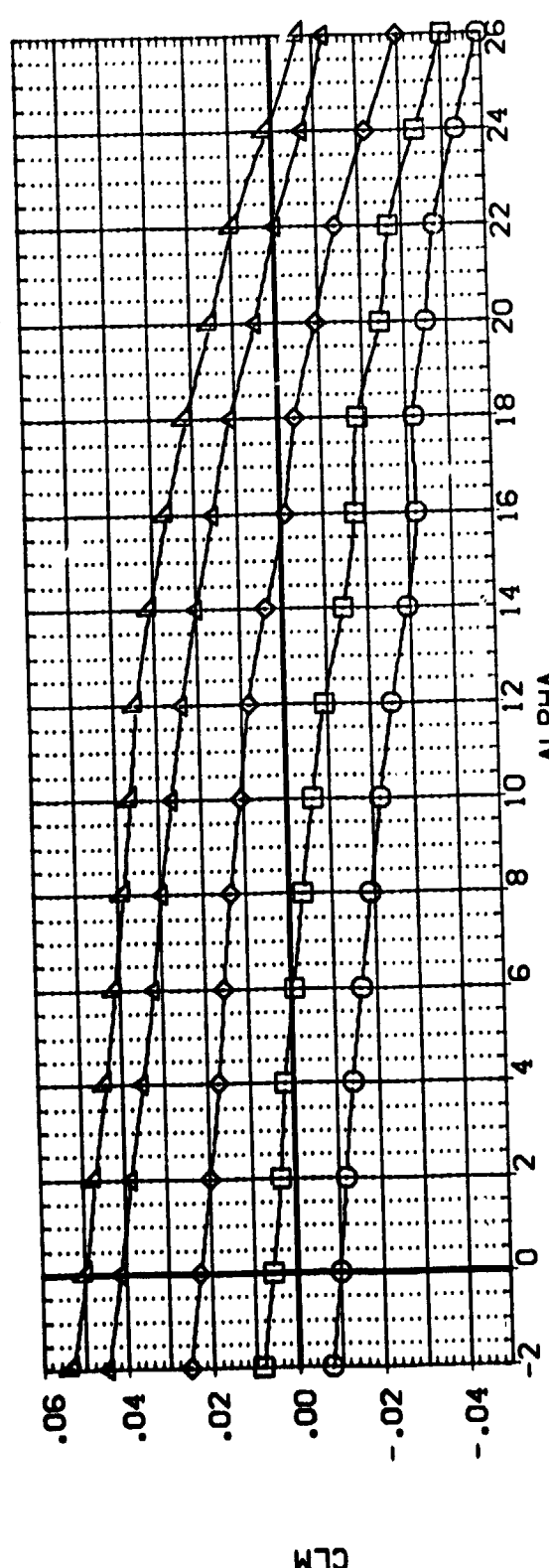
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(FP.002)	LA-23(LTPT-141)ARC LO-100 ORBITER (BV1VFB)	-5.000	.000	.000	.000	LREF 13.5000 INCHES
(FP.003)	LA-23(LTPT-141)ARC LO-100 ORBITER (BV1VFB)	-10.000	.000	.000	.000	BREF 10.5151 INCHES
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						SCALE .0100 SCALE



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

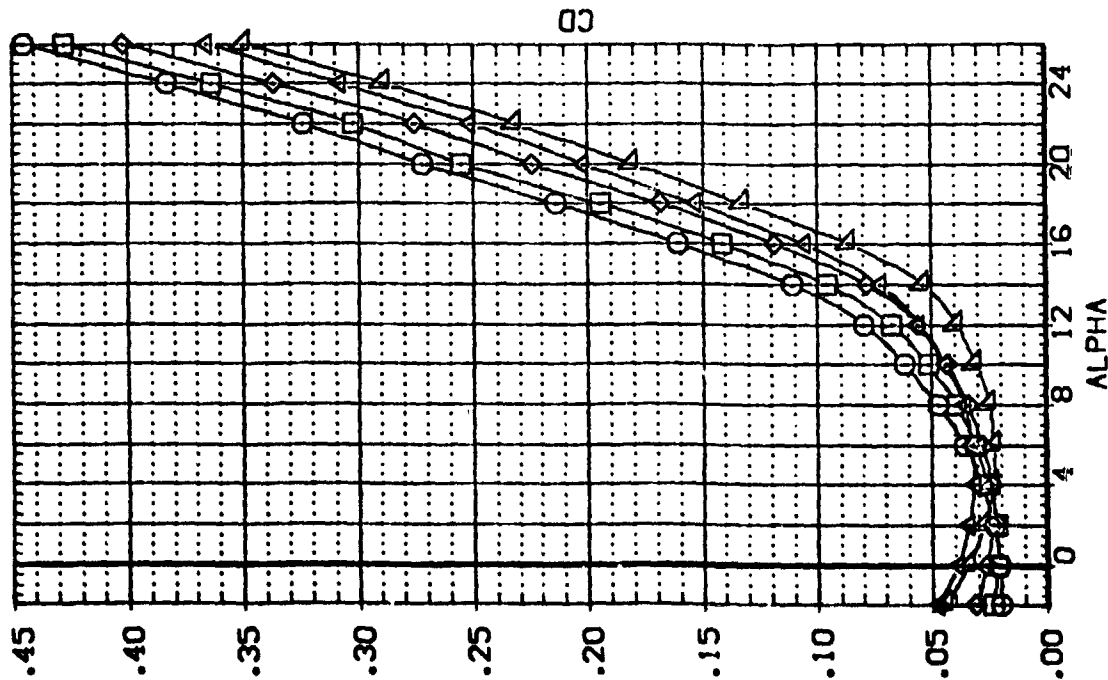
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(FPJ002)	LA-23(LTPT-141) LARC LG-100 ORBITER (BV/VFB)	-5.000	.000	.000	.000	LREF 13.5000 INCHES
(FPJ003)	LA-23(LTPT-141) LARC LG-100 ORBITER (BV/VFB)	-10.000	.000	.000	.000	BREF 10.5151 INCHES
(FPJ004)	LA-23(LTPT-141) LARC LG-100 ORBITER (BV/VFB)	-15.000	.000	.000	.000	XMRP 8.9100 INCHES
(FPJ005)	LA-23(LTPT-141) LARC LG-100 ORBITER (BV/VFB)	-15.000	.000	-18.000	.000	YMRP .0000 INCHES
						ZMRP .0000 INCHES
						SCALE .0100



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)
 (AJRN/L = 5.40)

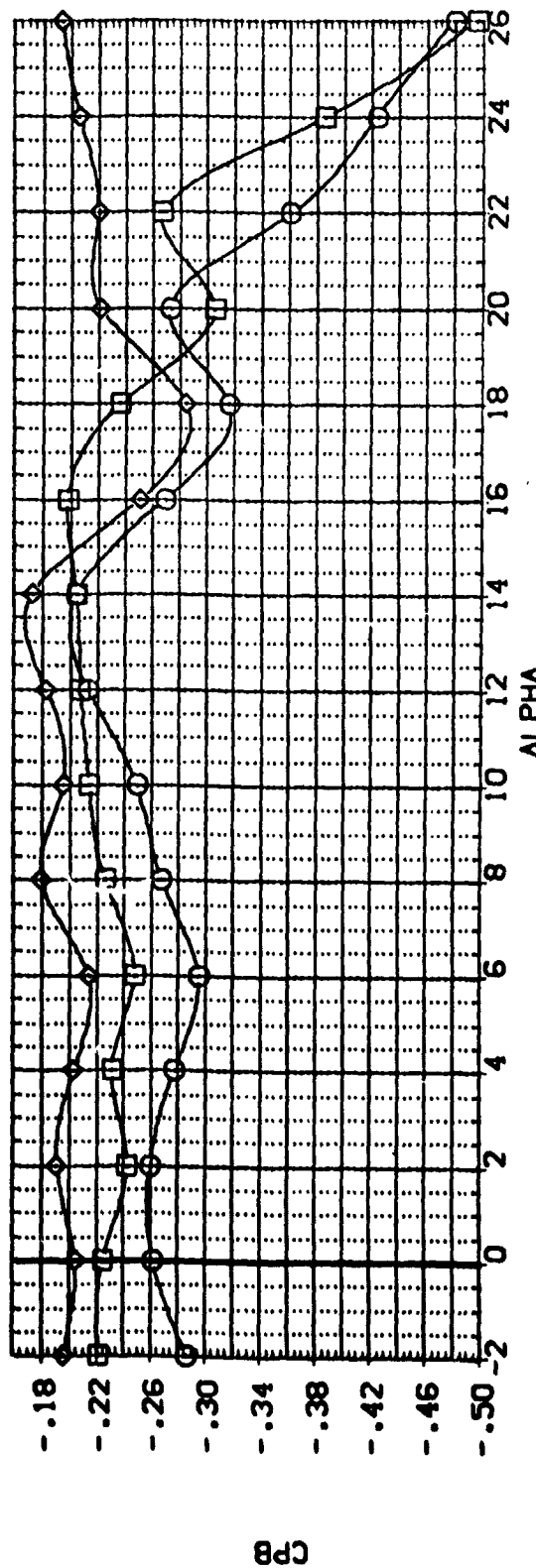
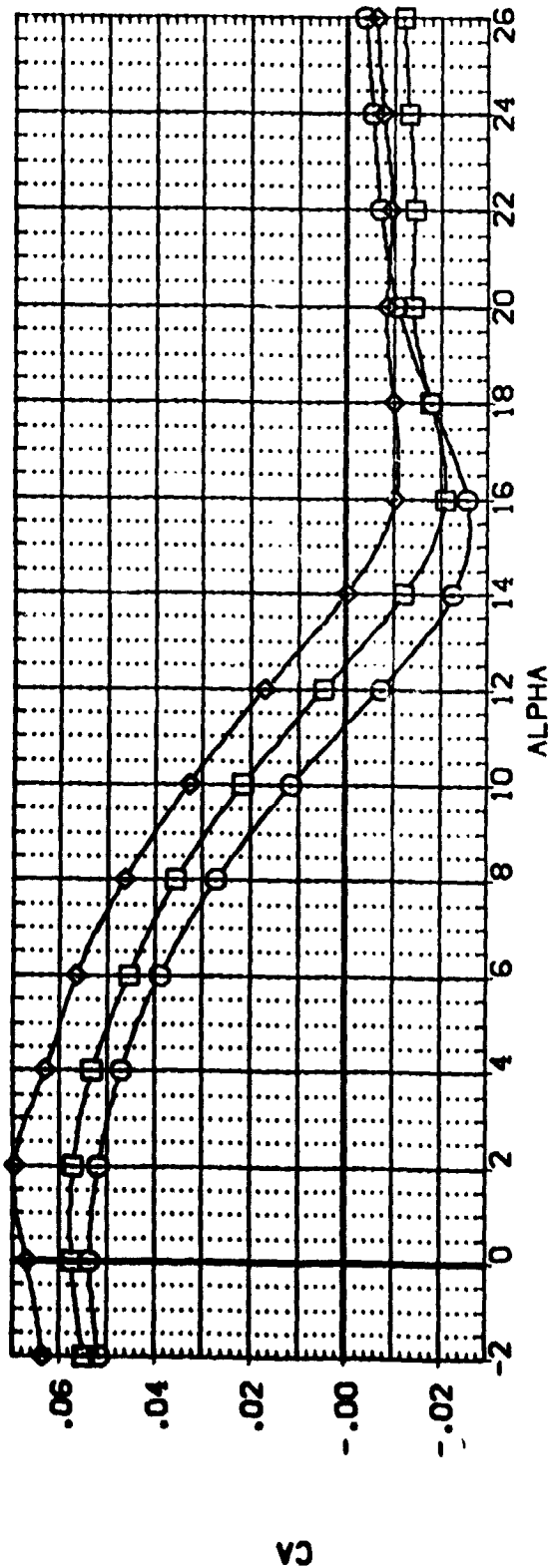
DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ELEVTR	AILRON	BOFLAP	RUDEL R	REFERENCE INFORMATION
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[FPL002]	LA-23(LTPT-141)ARC LO-100 QRB1TER (BW1VFB)	-5.000	.000	.000	.000	LREF 13.5000 INCHES
[FPL003]	LA-23(LTPT-141)ARC LO-100 QRB1TER (BW1VFB)	-10.000	.000	.000	.000	BREF 10.5151 INCHES
[FPL004]	LA-23(LTPT-141)ARC LO-100 QRB1TER (BW1VFB)	-15.000	.000	.000	.000	YARP 8.9100 INCHES
[FPL005]	LA-23(LTPT-141)ARC LO-100 QRB1TER (BW1VFB)	-15.000	.000	-18.000	.000	ZARP .0000 INCHES
						SCALE .0100 INCHES



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

(A)RN/L = 5.40

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ELEVTR	AIRLON	BOFLAP	RUDFLR	REFERENCE INFORMATION
(FPLO08)	LA-23(LTPT-141)ILARC LO-100 ORBITER (BWIVFB)	.000	.000	-18.000	20.000	SREF 49.9824 SQ. IN.
(FPLO07)	LA-23(LTPT-141)ILARC LO-100 ORBITER (BWIVFB)	-10.000	.000	-18.000	20.000	LREF 13.5000 INCHES
(FPLO06)	LA-23(LTPT-141)ILARC LO-100 ORBITER (BWIVFB)	-15.000	.000	-18.000	20.000	BREF 10.5151 INCHES
						XMRP 8.9100 INCHES
						YMRP .0000 INCHES
						ZMRP .0000 INCHES
						SCALE .0100 SCALE



ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(AJRN/L = 5.40

DATA SET SYMBOL: (FPJ008) (FPJ007) (FPJ006)

CONFIGURATION DESCRIPTION: LA-23(LTPT-141)ARC LO-100 ORBITER (BV/VF8) LA-23(LTPT-141)ARC LO-100 ORBITER (BV/VF8) LA-23(LTPT-141)ARC LO-100 ORBITER (BV/VF8)

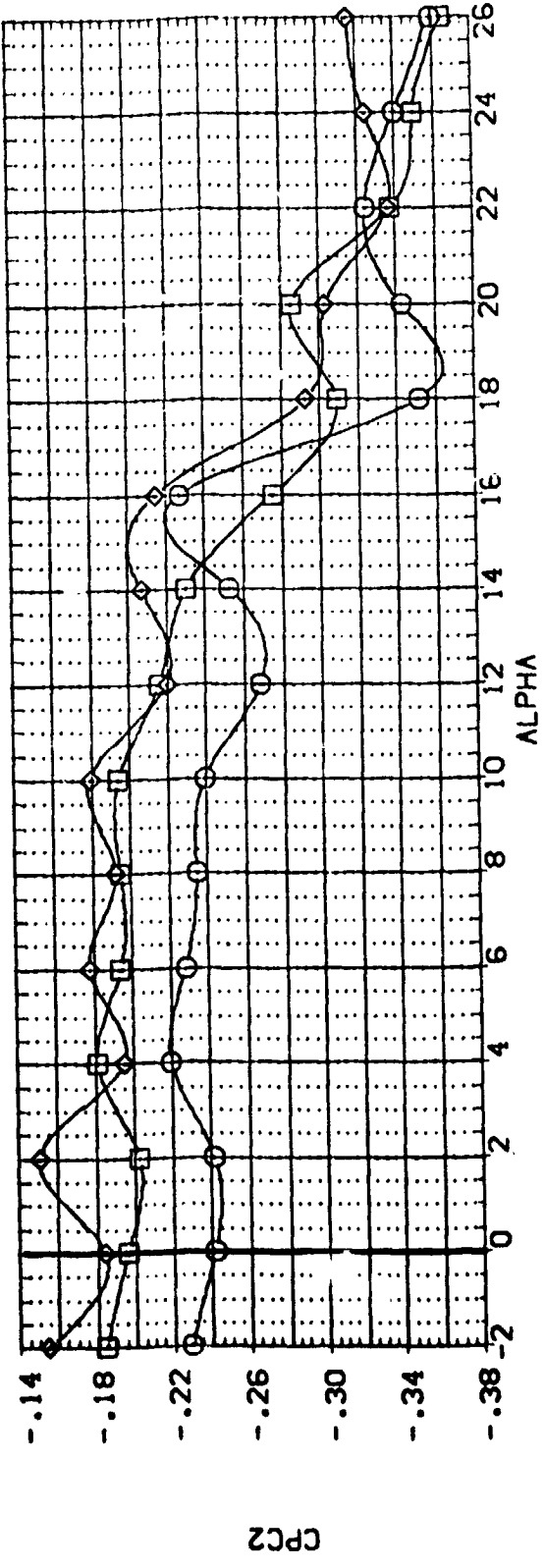
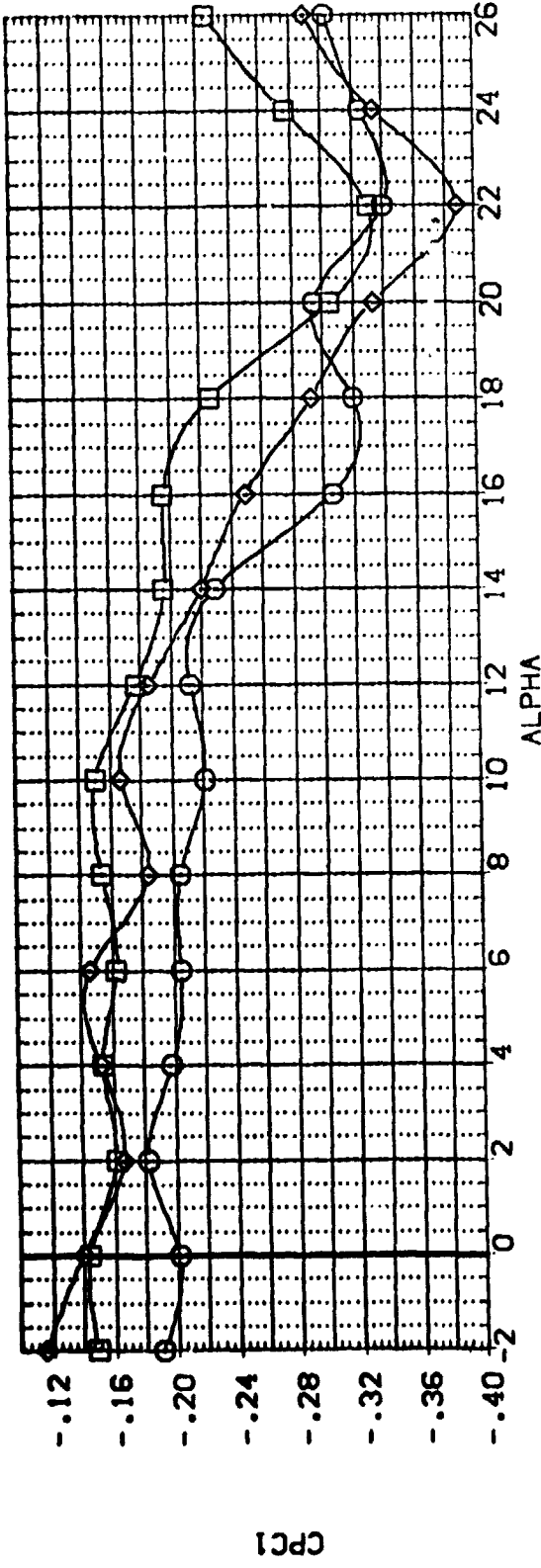
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AIRLON: .000 .000 .000

BDFLAP: -18.000 -18.000 -18.000

RUOFLR: 20.000 20.000 20.000

REFERENCE INFORMATION: SREF 49.9824 SC IN LREF 13.5000 INCES BREF 10.5151 INCES XREF 8.9100 INCES YREF .0000 INCES ZREF .0000 INCES SCALE .0100

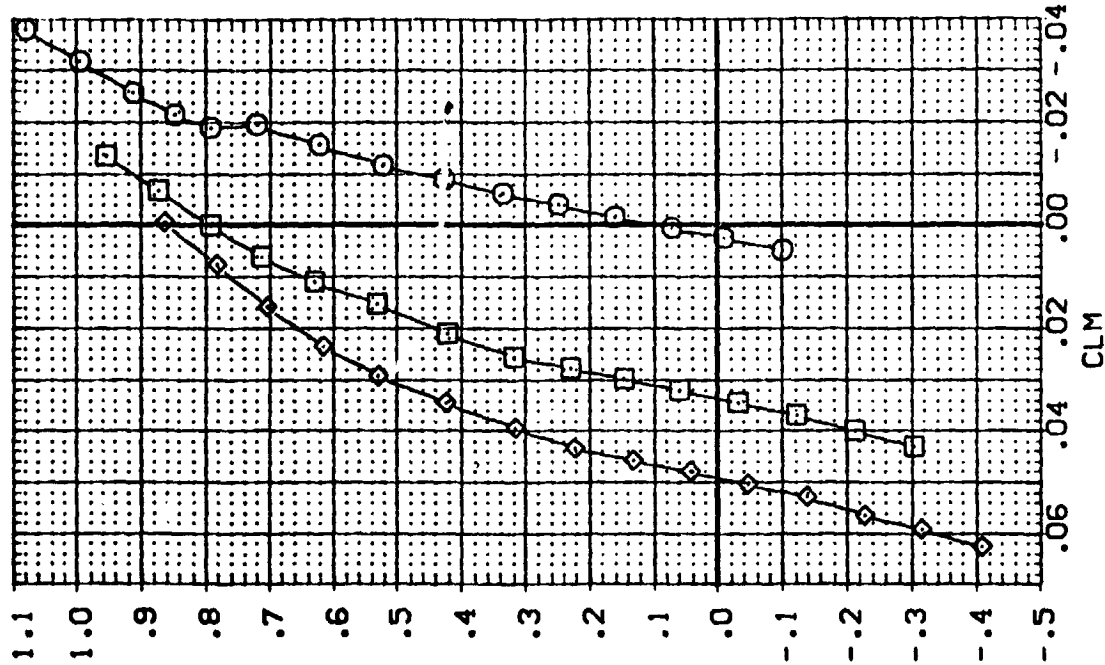
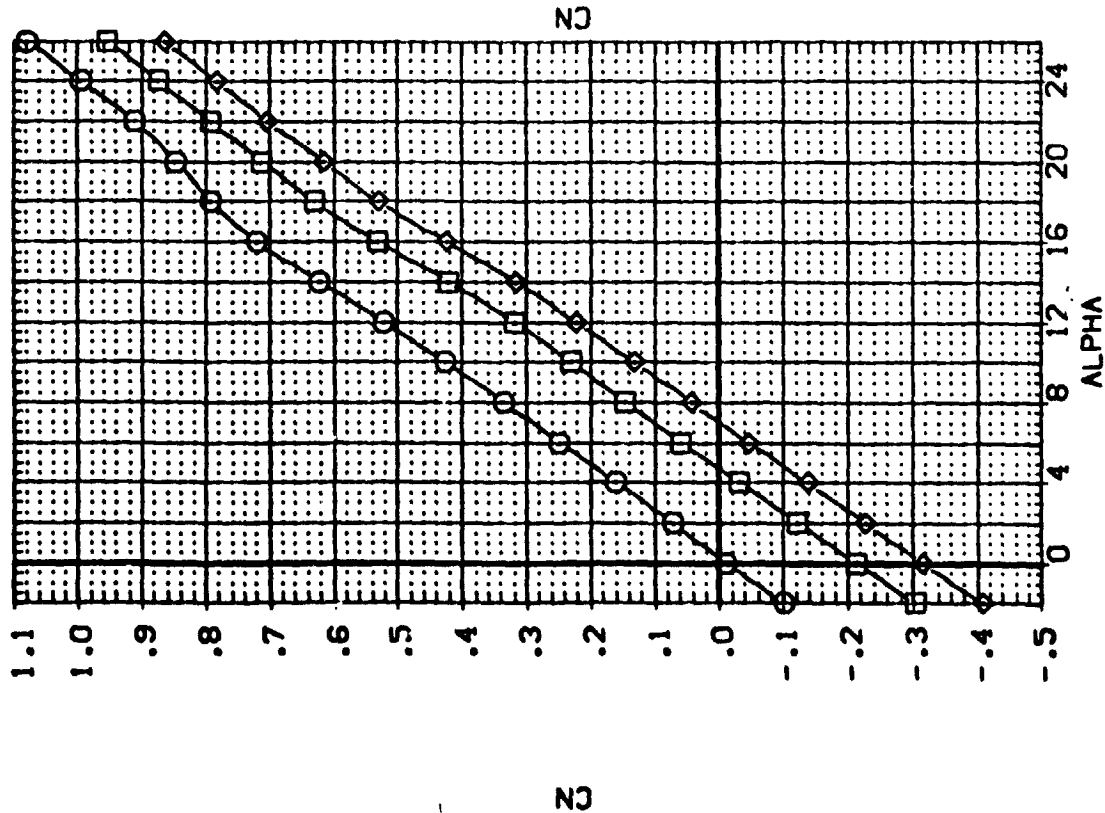


ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(A)RN/L = 5.40



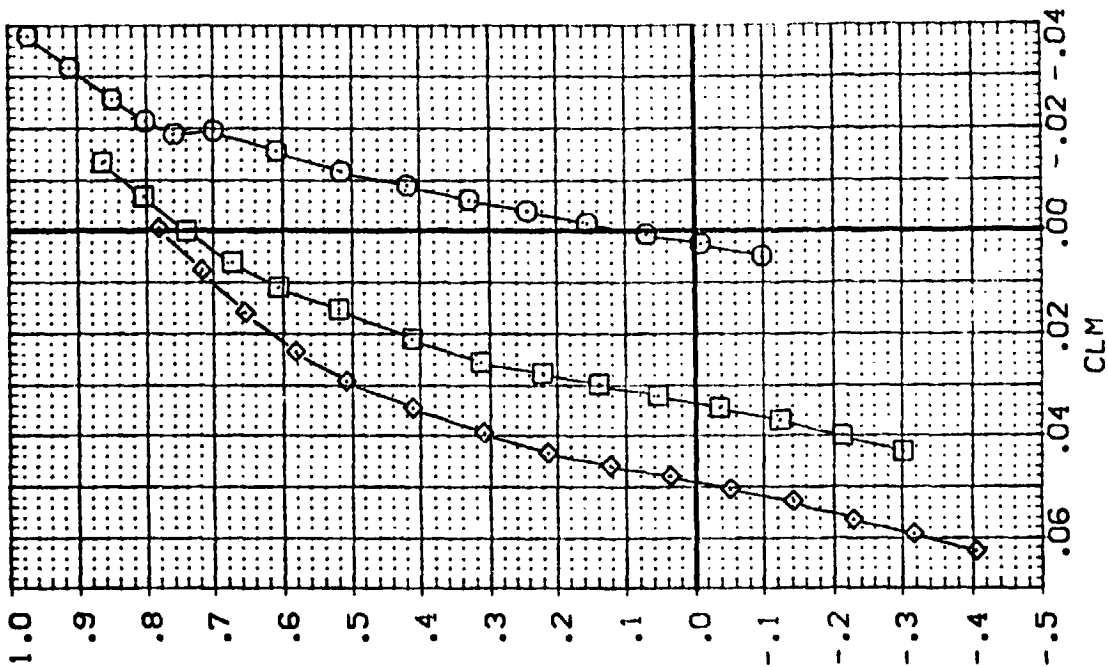
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(FPJ008)	LA-23(LTPT-141)ARC LG-100 ORBITER (BVIVFB)	.000	.000	-18.000	20.000	SREF 49.9824 50. IN.
(FPJ007)	LA-23(LTPT-141)ARC LG-100 ORBITER (BVIVFB)	-10.000	.000	-18.000	20.000	LREF 13.5000 INCHES
(FPJ006)	LA-23(LTPT-141)ARC LG-100 ORBITER (BVIVFB)	-15.000	.000	-18.000	20.000	BREF 10.5151 INCHES
						XMRP 8.9100 INCHES
						YMRP .0000 INCHES
						SCALE .0100



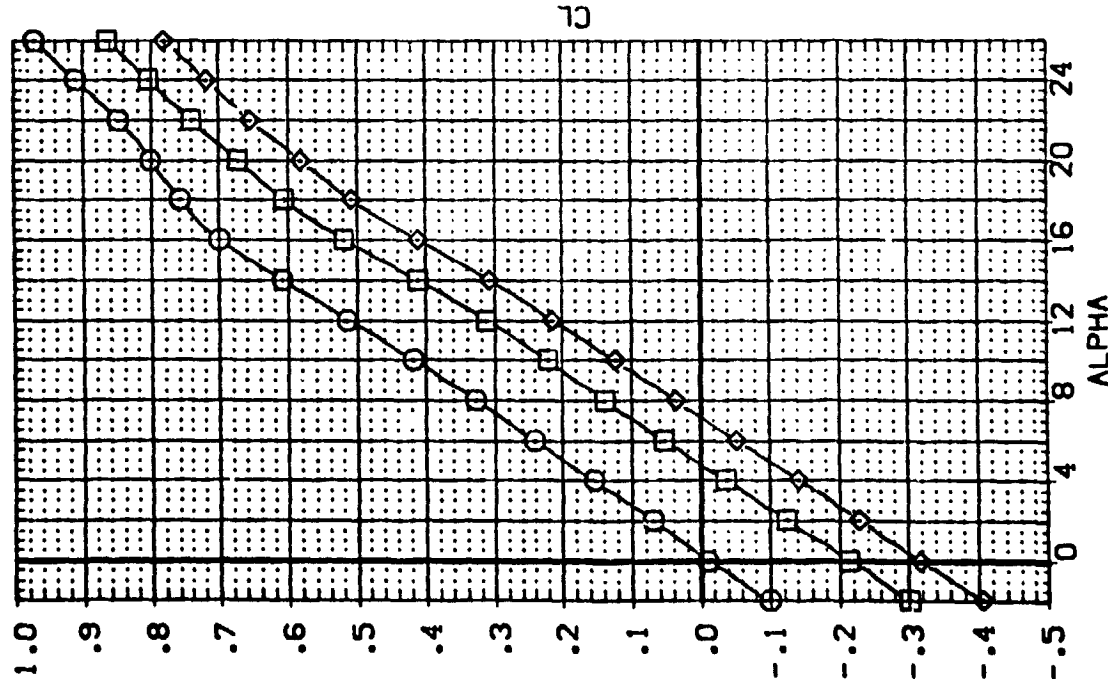
ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(A)RN/L = 5.40

ELEV1R	AILRON	BOFLAP	RUDFLR	REFERENCE INFORMATION
.000	.000	-18.000	20.000	SREF 49.9824 50.1N
-10.000	.000	-18.000	20.000	LREF 13.5000 INCHES
-15.000	.000	-18.000	20.000	BREF 10.5151 INCHES
				YMRP 8.9100 INCHES
				ZMRP .0000 INCHES
				SCALE .0100 SCALE



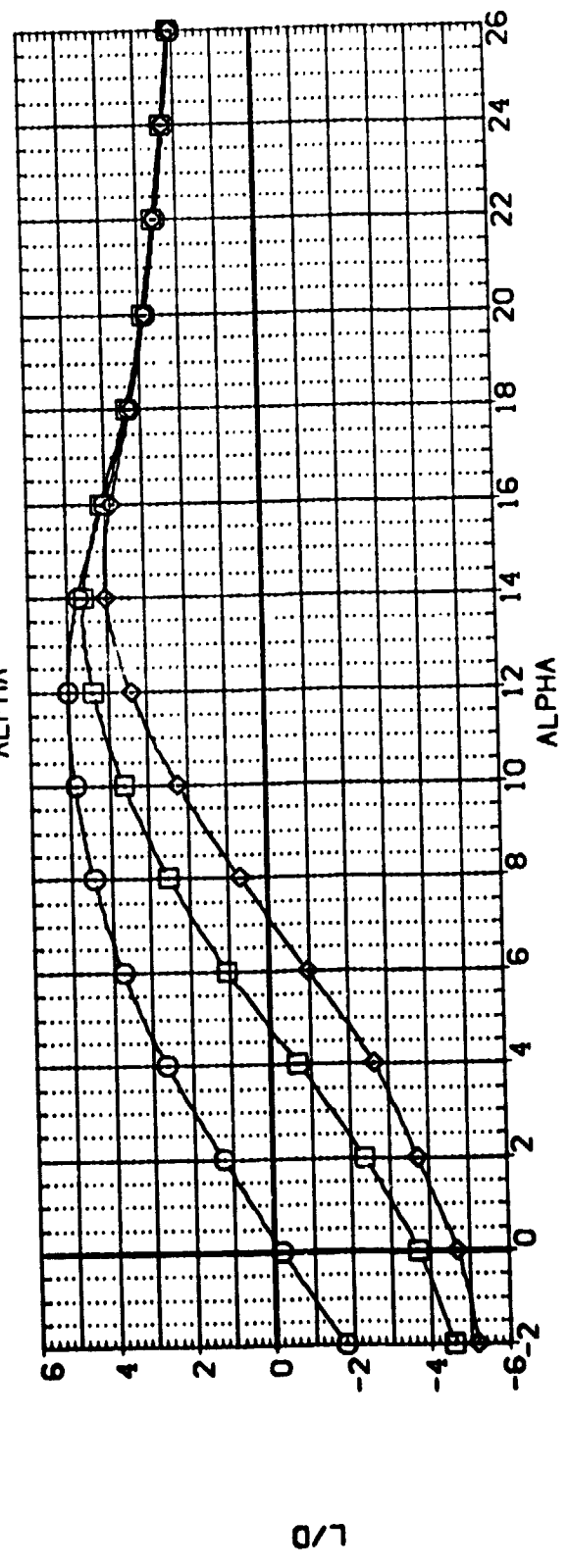
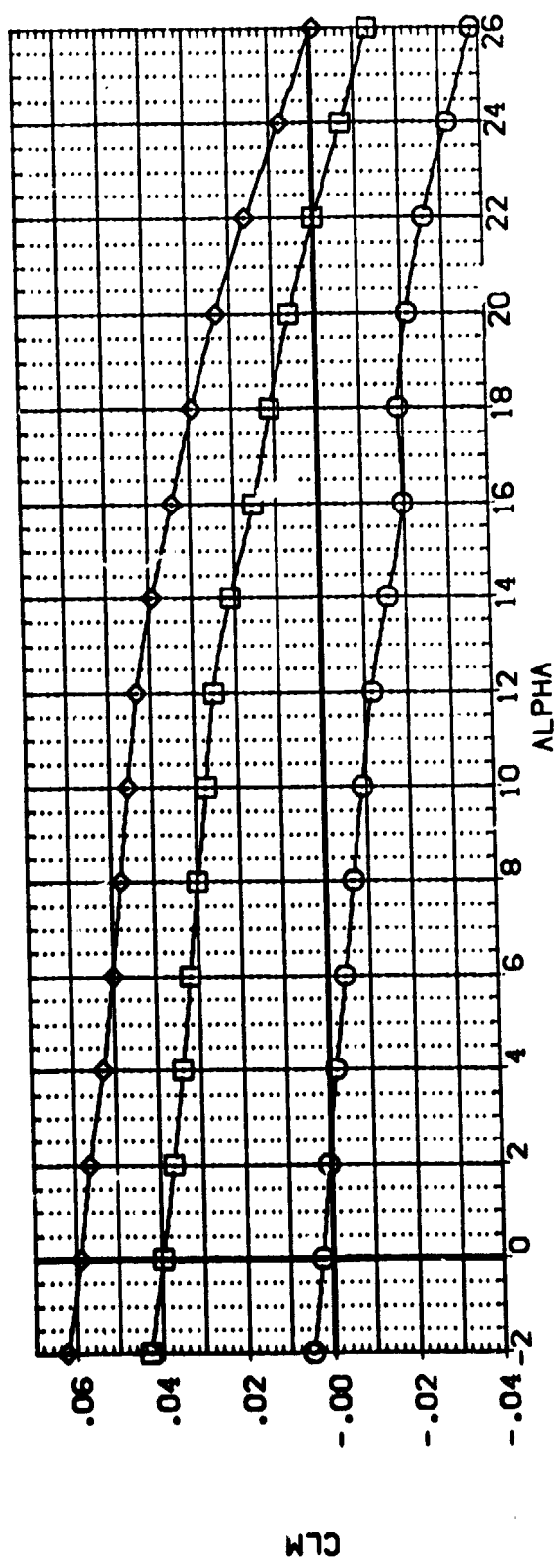
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(FPJ008)	LA-23(LTPT-141)ARC LO-100 ORBITER (BWVFB)
(FPJ007)	LA-23(LTPT-141)ARC LO-100 ORBITER (BWVFB)
(FPJ006)	LA-23(LTPT-141)ARC LO-100 ORBITER (BWVFB)



ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(AJRN/L = 5.40

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ELEVTR	AIRLON	BDFLAP	RUOFLR	REFERENCE INFORMATION
(FPJ008)	LA-23(LTPT-14)ILARC LG-100 DBI/ER (RWIVFB)	.000	.000	-18.000	20.000	SREF 49.9824 SQ.IN.
(FPJ007)	LA-23(LTPT-14)ILARC LG-100 DBI/L (RWIVFB)	-10.000	.000	-18.000	20.000	LREF 13.5000 INCHES
(FPJ006)	LA-23(LTPT-14)ILARC LG-100 DBI/TER (RWIVFB)	-15.000	.000	-18.000	20.000	BREF 10.5151 INCHES
						XWRP 8.9100 INCHES
						YWRP .0000 INCHES
						ZWRP .0000 INCHES
						SCALE .0100 INCHES



ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

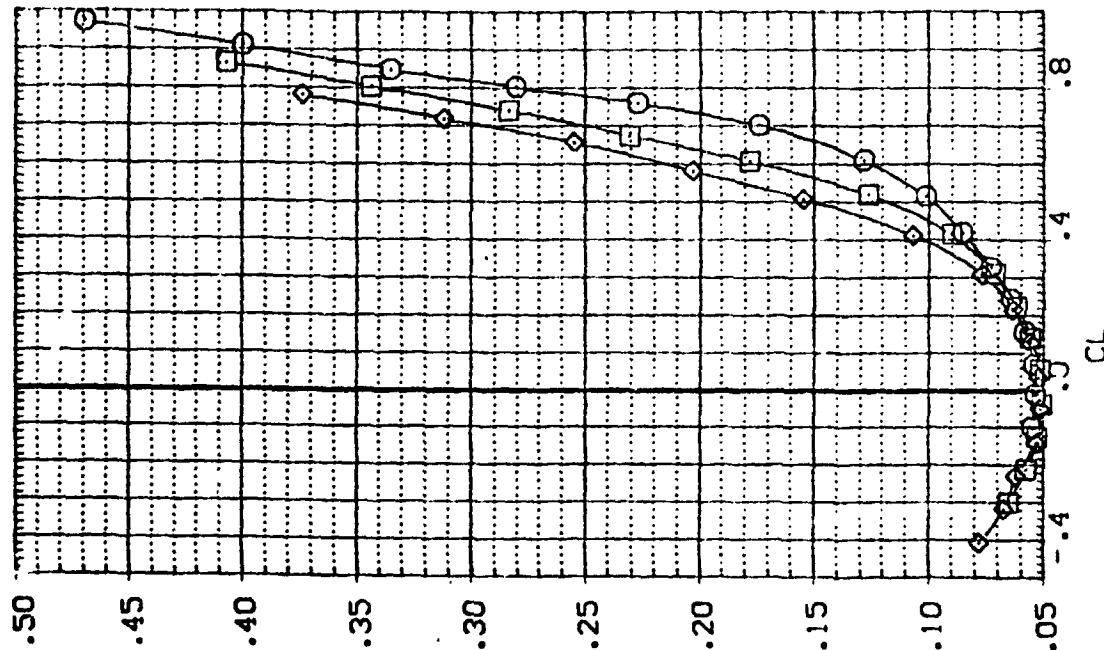
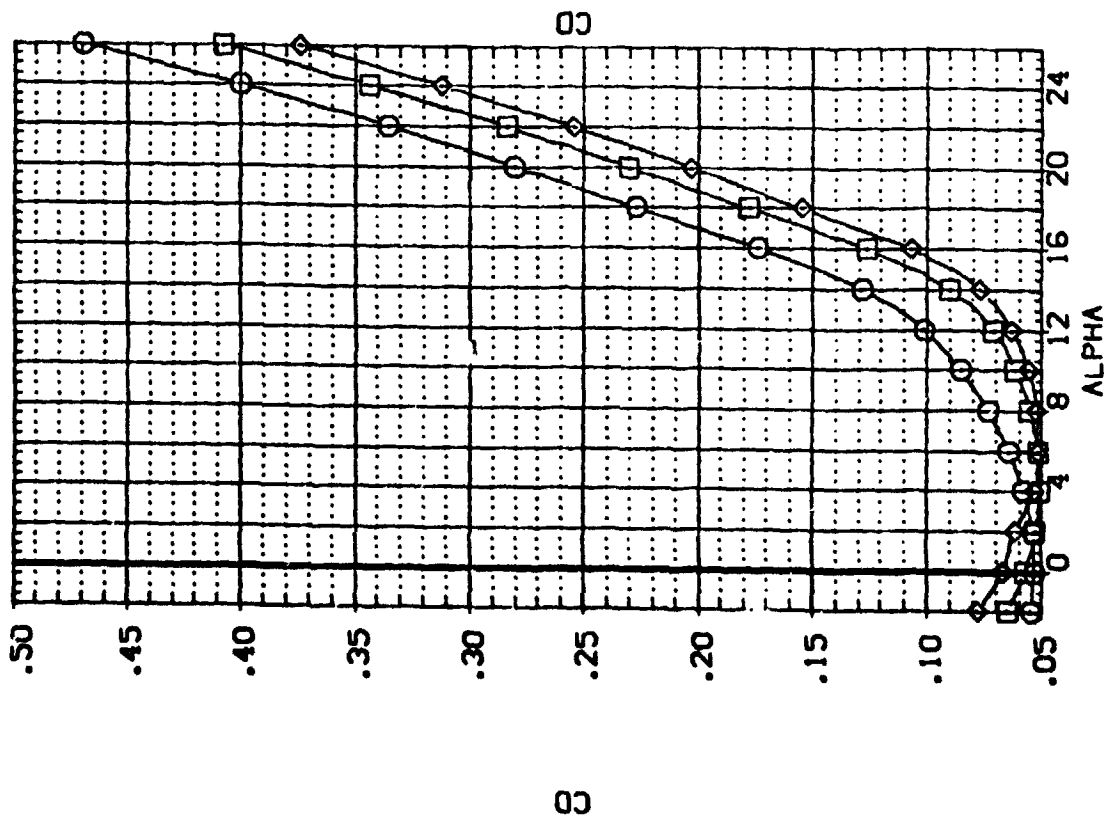
(AJRN/L = 5.40

DATA SET SYMBOL

(FPJ006) LA-23(LTPT-14)ILARC LO-100 ORBITER (BWIVB)
 (FPJ007) LA-23(LTPT-14)ILARC LO-100 ORBITER (BWIVB)
 (FPJ008) LA-23(LTPT-14)ILARC LO-100 ORBITER (BWIVB)

ELEVTR ALLRON BOFLAP RUOFLR
 .000 .000 -18.000 20.000
 -10.000 .000 -18.000 20.000
 -15.000 .000 -18.000 20.000

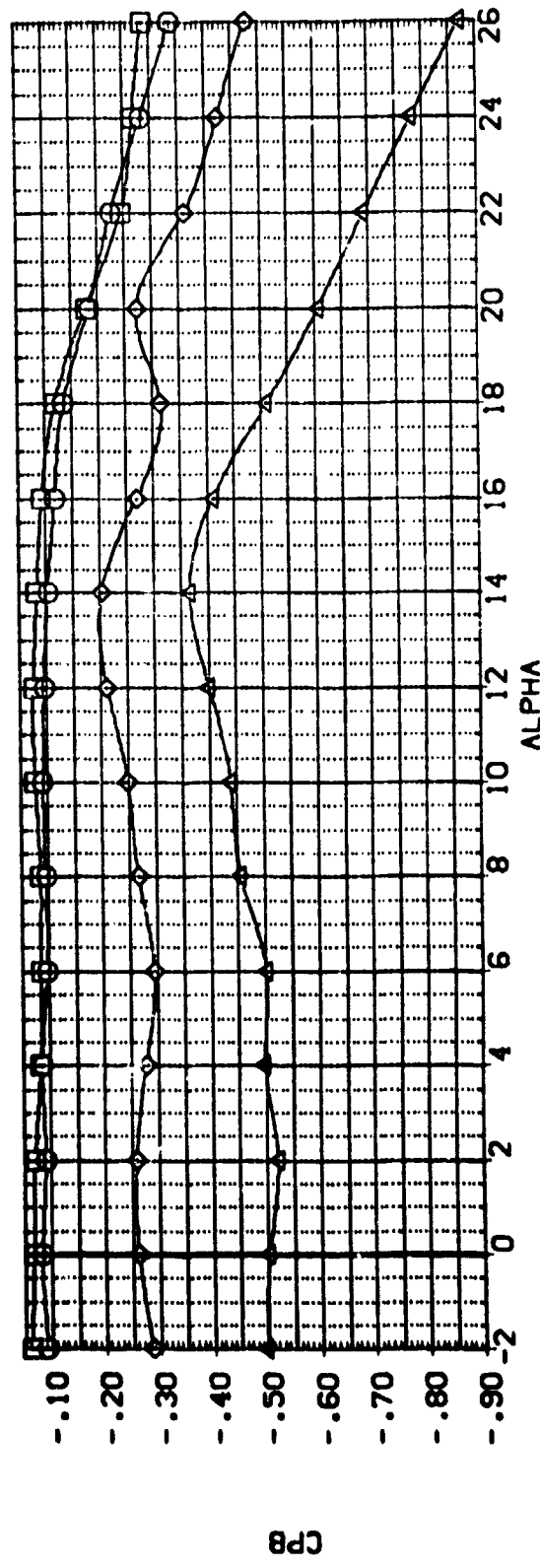
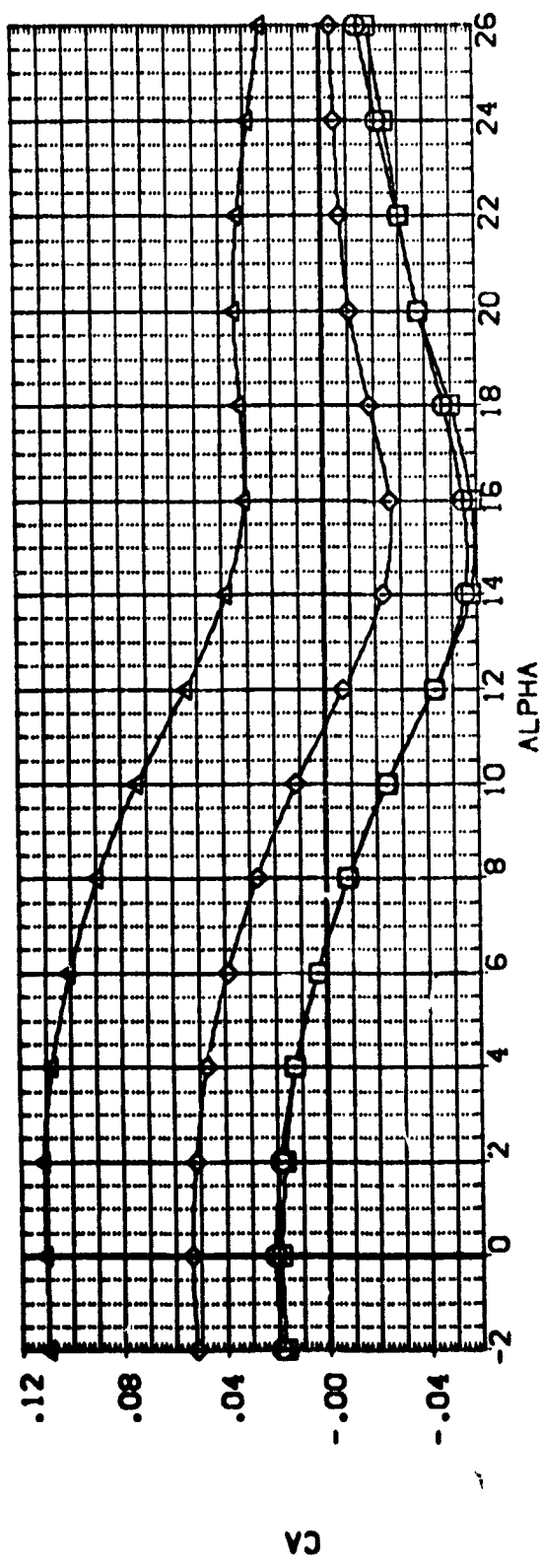
REFERENCE INFORMATION
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 LREF 13.5000 SCALN
 BREF 10.5151 SCALN
 XMRP 8.9100 SCALN
 YMRP .0000 SCALN
 ZMRP .0000 SCALN
 SCALE .0100 SCALN



ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(AJRN/L = 5.40

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ELEVTR	AILTRON	BDFLAP	RUOFLR	REFERENCE INFORMATION
(FPJ001)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	49.9824 SQ. IN.
(FPJ002)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	13.5000 INCHES
(FPJ003)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	10.5151 INCHES
(FPJ004)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	8.9100 INCHES
(FPJ005)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	.0000 INCHES
(FPJ006)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	.0100 INCHES
(FPJ007)	LA-23(LTPT-14)ILARC LO-100 ORBITER (BVIVFB)	.000	.000	.000	.000	SCALE

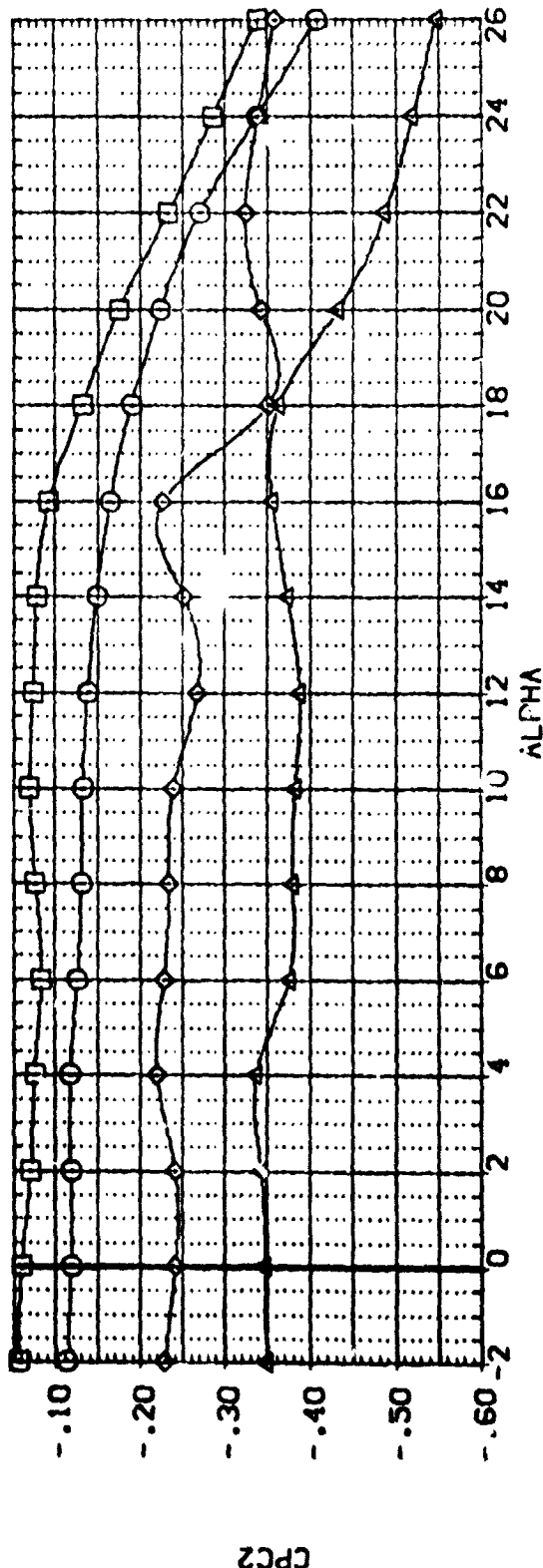
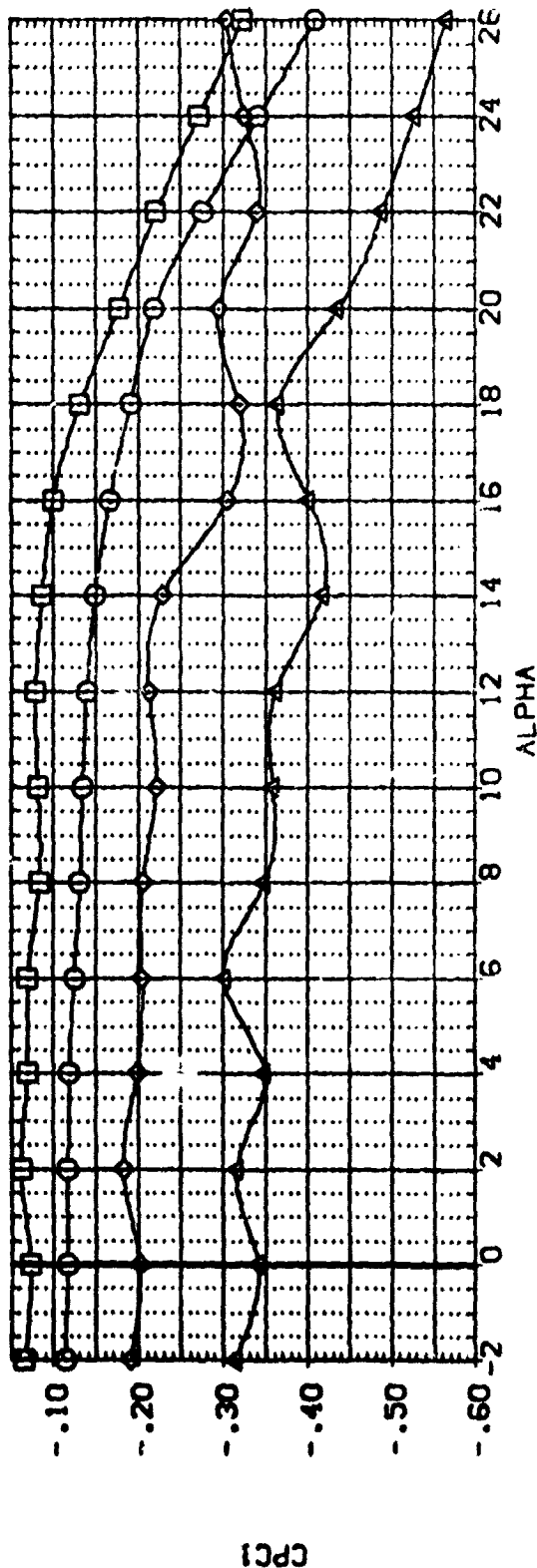


EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

(A)RN/L = 5.40

DATA SET SYMOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION

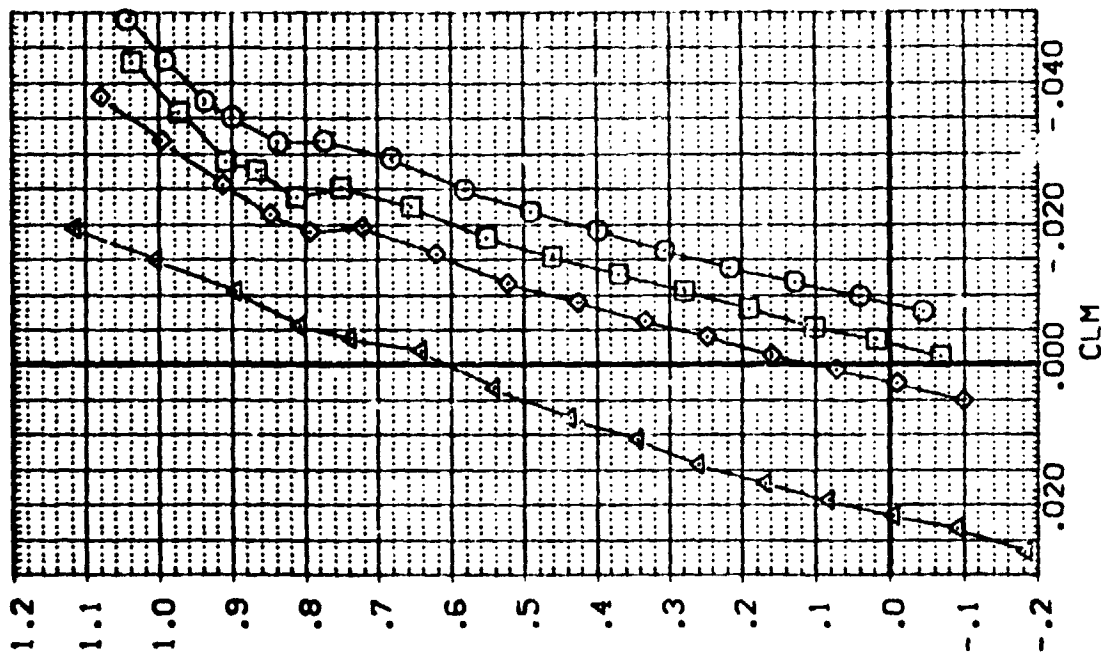
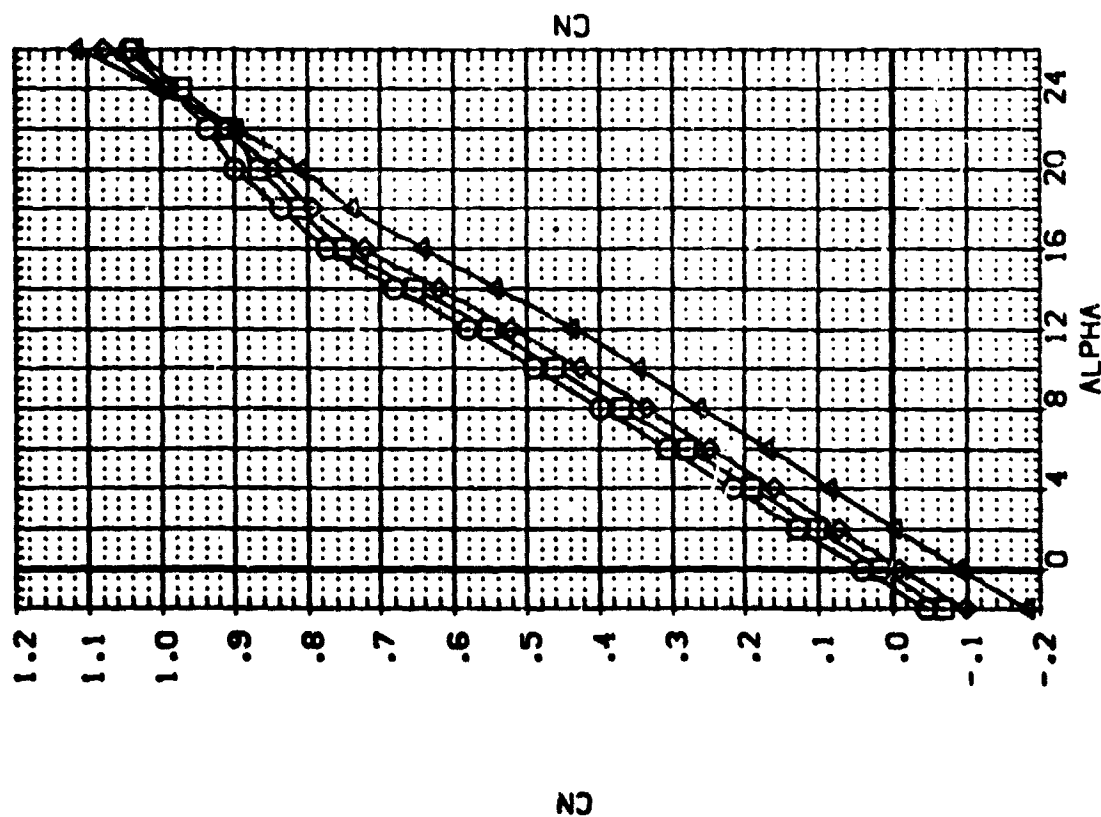
DATA SET SYMOL	CONFIGURATION DESCRIPTION	ELEVTR	AILERON	BOFLAP	RUOFLR	REFERENCE INFORMATION
(FPU001)	LA-23(LTPT-14)ILARC LO-100 OXB/ITER (BV/VFB)	.000	.000	.000	.000	49.9824 SQ.IN.
(FPU002)	LA-23(LTPT-14)ILARC LO-100 OXB/ITER (BV/VFB)	.000	.000	-18.000	.000	13.5000 INCHES
(FPU003)	LA-23(LTPT-14)ILARC LO-100 OXB/ITER (BV/VFB)	.000	.000	-18.000	20.000	10.5151 INCHES
(FPU010)	LA-23(LTPT-14)ILARC LO-100 OXB/ITER (BV/VFB)	.000	.000	-18.000	40.000	8.5100 INCHES
						YMRP .0000 INCHES
						ZMRP .0000 INCHES
						SCALE .0100 INCHES



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

(A)RN/L = 5.40

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	ELEVTR	AILDRN	80FLAP	R0FLR	REFERENCE INFORMATION
(FPL001)	LA-23(LTPT-14)FLARC LO-100 CRBTER (BW/VFB)	.000	.000	.000	.000	SREF 49.9824 SC.IN.
(FPL008)	LA-23(LTPT-14)FLARC LO-100 CRBTER (BW/VFB)	.000	.000	-18.000	.000	LREF 13.5000 INCHES
(FPL009)	LA-23(LTPT-14)FLARC LO-100 CRBTER (BW/VFB)	.000	.000	-18.000	20.000	BREF 10.5151 INCHES
(FPL010)	LA-23(LTPT-14)FLARC LO-100 CRBTER (BW/VFB)	.000	.000	-18.000	40.000	XMRP 8.9100 INCHES
						YMRP .0000 INCHES
						ZMRP .0000 INCHES
						SCALE .0100



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)
 (A)RN/L = 5.40

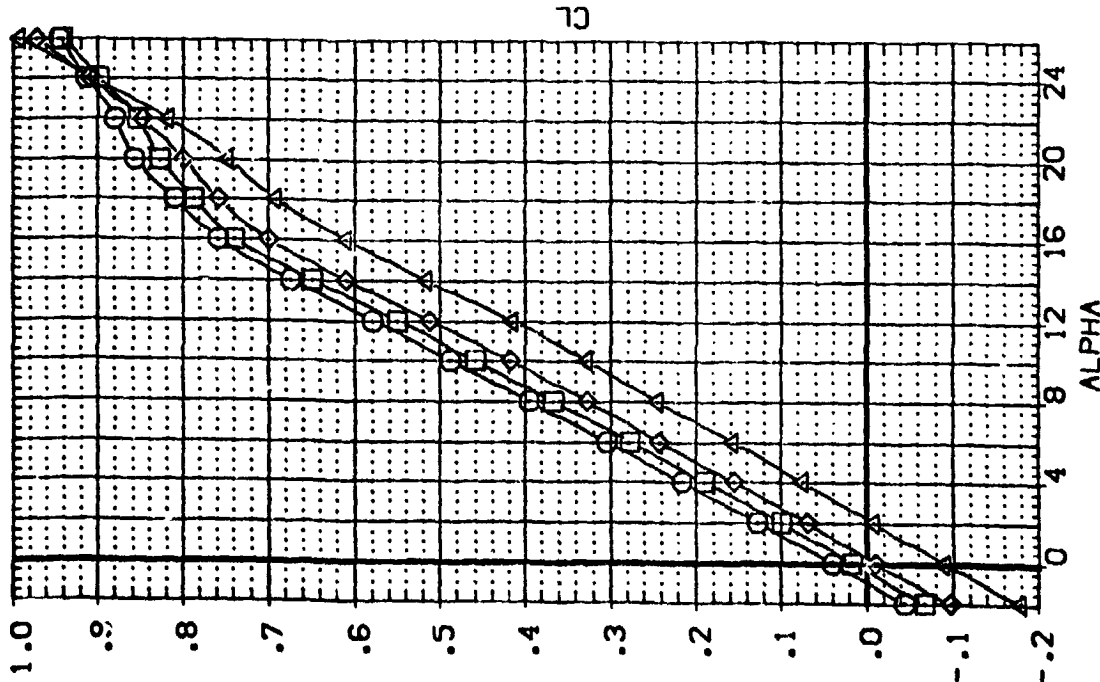
DATA SET SYMBOL CONFIGURATION DESCRIPTION

(FP001) LA-23(LTPT-141) LARC LG-100 DRB1TER (BM1VFB)

(FP002) LA-23(LTPT-141) LARC LG-100 DRB1TER (BM1VFB)

(FP003) LA-23(LTPT-141) LARC LG-100 DRB1TER (BM1VFB)

(FP004) LA-23(LTPT-141) LARC LG-100 DRB1TER (BM1VFB)



ELEVTR AILRON BOFLAP RUFLR REFERENCE INFORMATION

.000 .000 .000 .000 SREF 49.9824 50. IN.

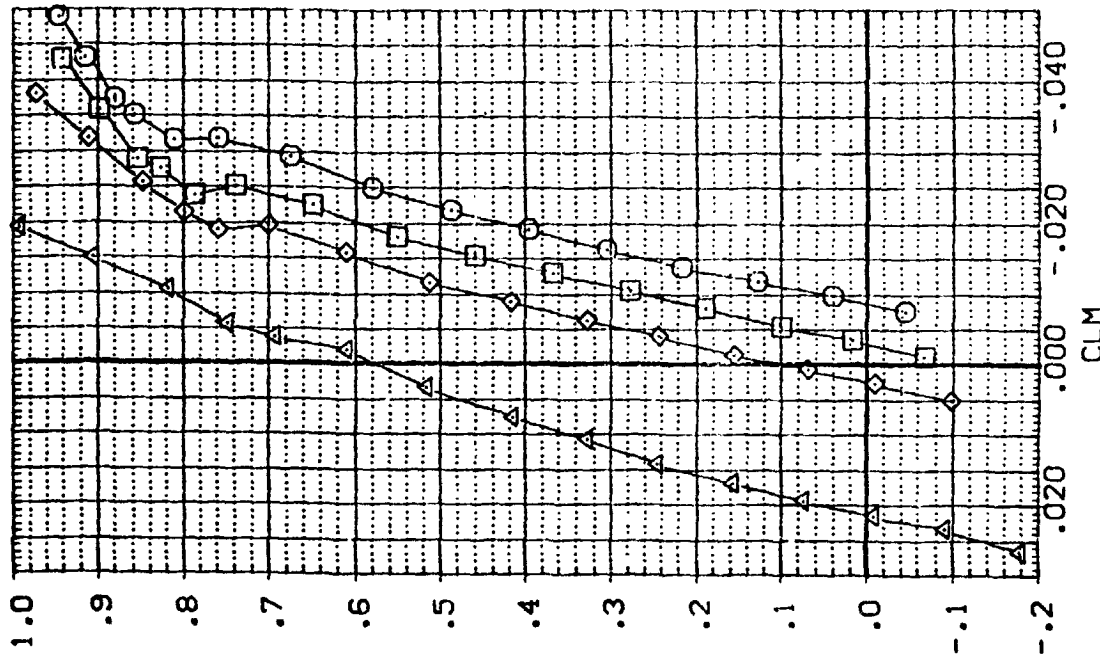
.000 .000 .000 .000 LREF 13.5000 INCHES

.000 .000 .000 .000 BRFP 10.5151 INCHES

.000 .000 .000 .000 YMRP 8.9100 INCHES

.000 .000 .000 .000 ZMRP .0000 INCHES

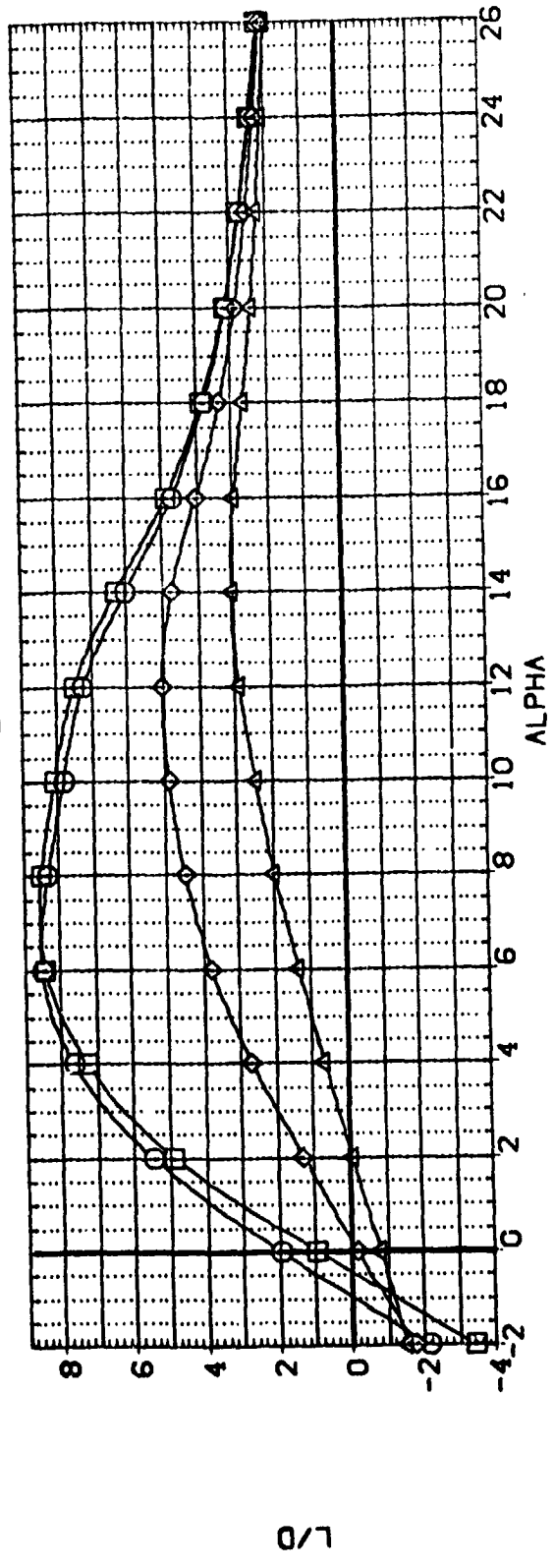
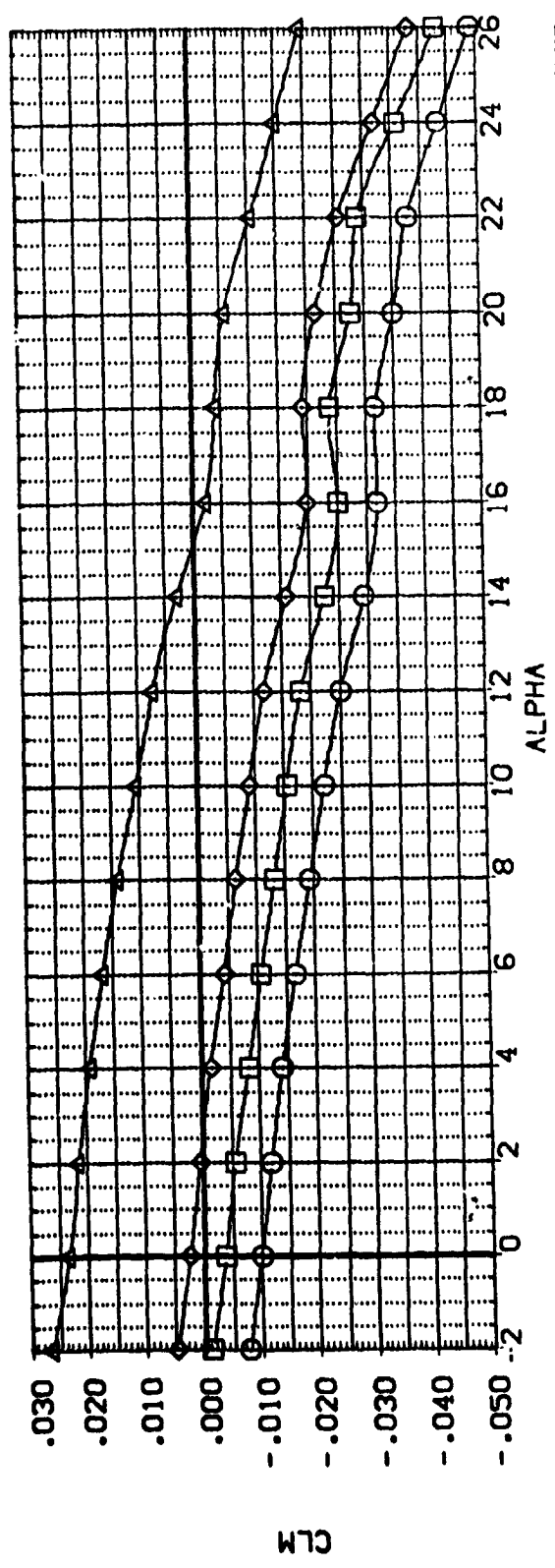
.000 .000 .000 .000 SCALE .0100 SCALE



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

(AJRN/L = 5.40)

DATA SET SYMBOL	CONF IGURATION DESCRIPTION	ELEVTR	AIRRN	BOFLAP	RUOFLR	REFERENCE INFORMATION
(FPL001)	LA-23(LTPT-141) LARC LG-100 ORBITER (BN/VFB)	.000	.000	.000	.000	SREF 49.9824 SQ IN.
(FPL008)	LA-23(LTPT-141) LARC LG-100 ORBITER (BN/VFB)	.000	.000	-18.000	.000	LREF 13.5000 INCHES
(FPL010)	LA-23(LTPT-141) LARC LG-100 ORBITER (BN/VFB)	.000	.000	-18.000	20.000	BREF 10.5151 INCHES
				-18.000	40.000	YMRP 8.9100 INCHES
						ZMRP .0000 INCHES
						SCALE .0100

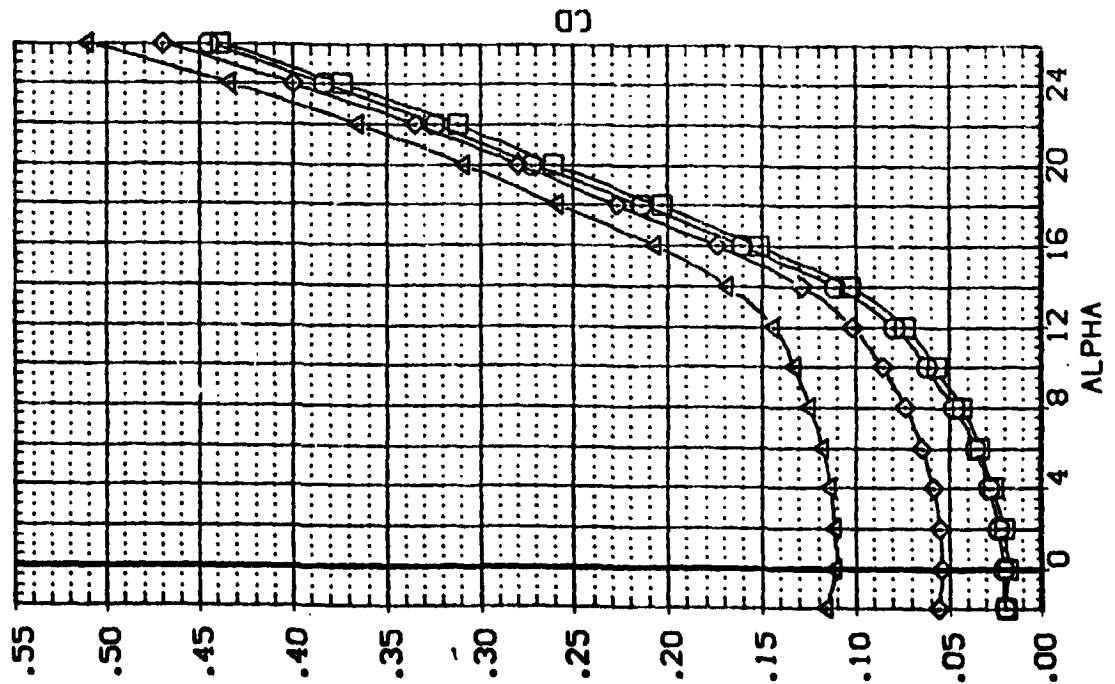
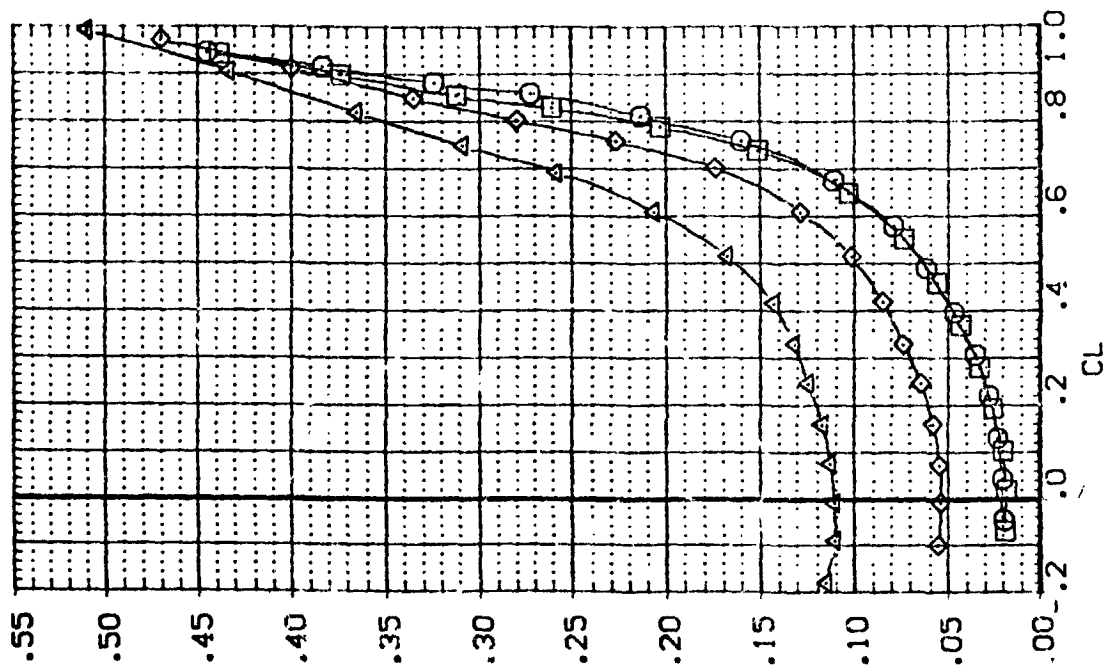


EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

(AIRN/L = 5.40)

ELEVTR	AILRON	BOFLAP	RUDFLR	REFERENCE INFORMATION
.000	.000	.000	.000	SREF 49.9824
.000	.000	.000	.000	LREF 13.9000
.000	.000	.000	.000	BREF 10.5151
.000	.000	.000	.000	XMRP 8.9100
.000	.000	.000	.000	YMRP .0000
.000	.000	.000	.000	ZMRP .0000
.000	.000	.000	.000	SCALE .0100

DATA SET SYMBOL	CONFIGURATION DESCRIPTION
[FPJ001]	LA-23(LTPT-14) LARC LO-100 ORBITER (BV1VFB)
[FPJ009]	LA-23(LTPT-14) LARC LO-100 ORBITER (BV1VFB)
[FPJ008]	LA-23(LTPT-14) LARC LO-100 ORBITER (BV1VFB)
[FPJ010]	LA-23(LTPT-14) LARC LO-100 ORBITER (BV1VFB)



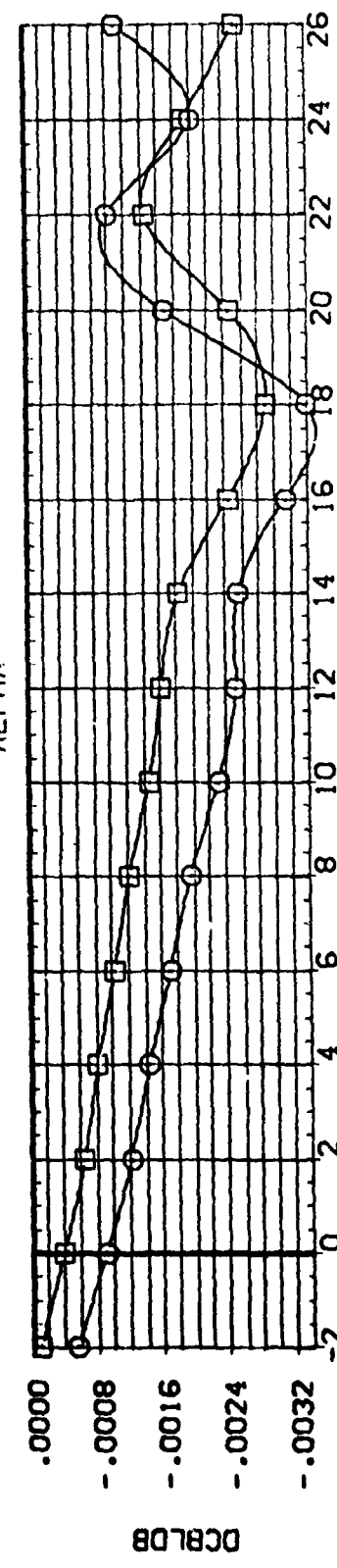
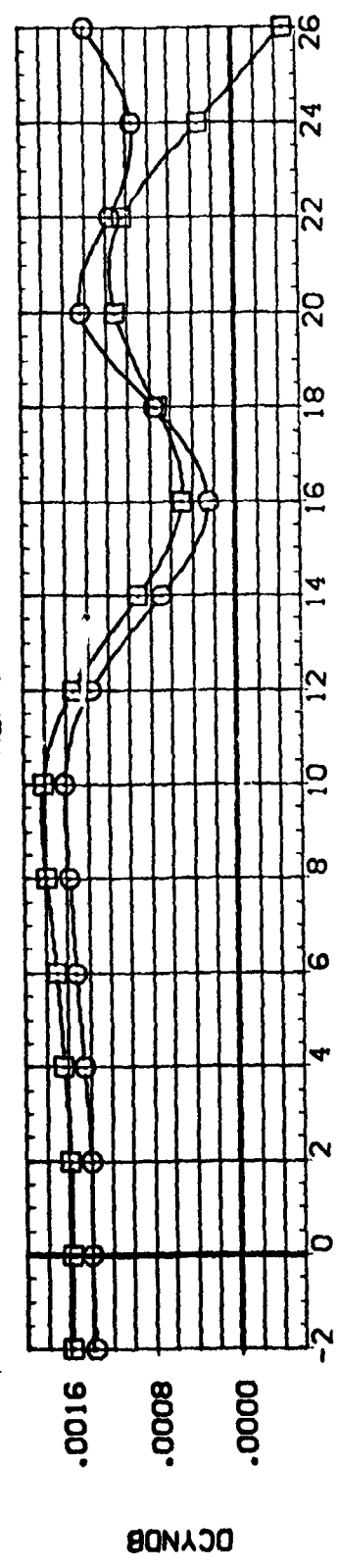
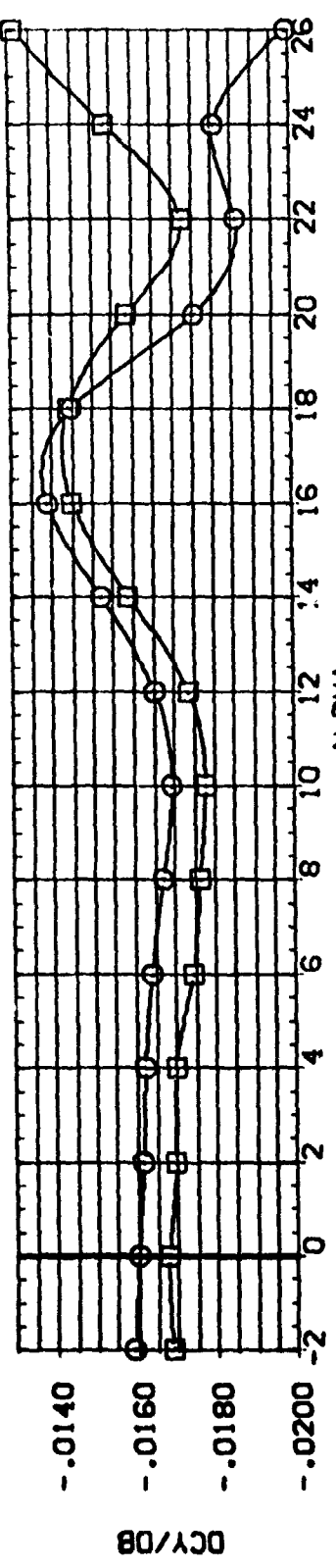
EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)
 (A)RN/L = 5.40

DATA SET SYMBOL: **LA-23(LTPT-14)ILARC LO-100 ORBITER (BN/VFB)**
 (CP0011) **LA-23(LTPT-14)ILARC LO-100 ORBITER (BN/VFB)**
 (CP0012)

CONFIGURATION DESCRIPTION:
 LA-23(LTPT-14)ILARC LO-100 ORBITER (BN/VFB)
 LA-23(LTPT-14)ILARC LO-100 ORBITER (BN/VFB)

REFERENCE INFORMATION:
 SREF: 49.9824 SC.IN: 10.5151
 LREF: 13.5000 INCHES: 10.5151
 BREF: 8.9100 INCHES: 10.5151
 XMRP: .0000 INCHES: 10.5151
 YMRP: .0000 INCHES: 10.5151
 ZMRP: .0000 INCHES: 10.5151
 SCALE: .0100

BETA: 5.000
 ELEVTR: .000
 BOFLAP: -18.000
 RUOFLR: .000
 RUOFLR: 20.000

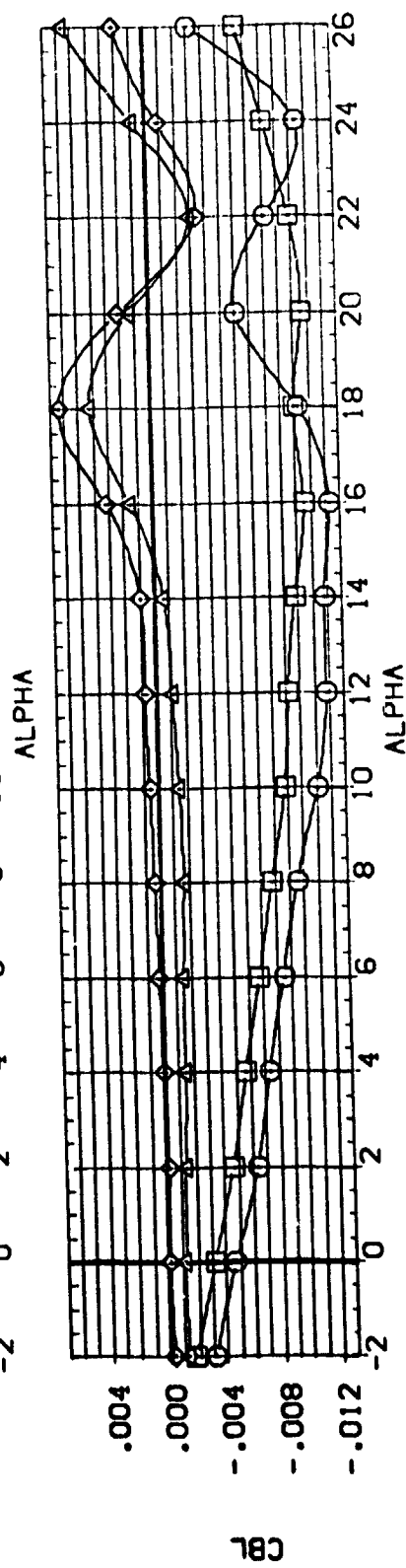
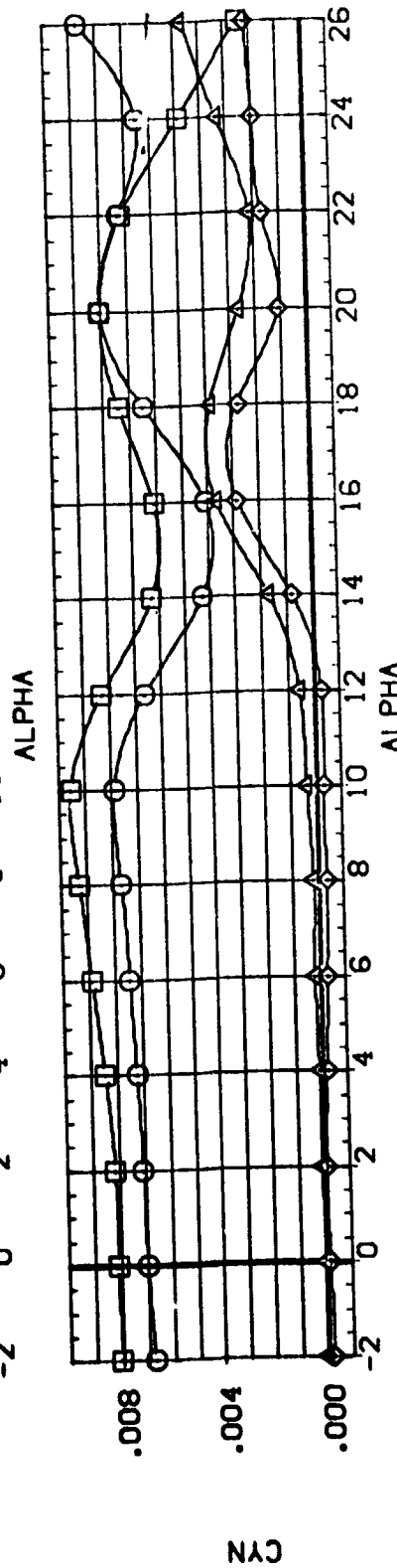
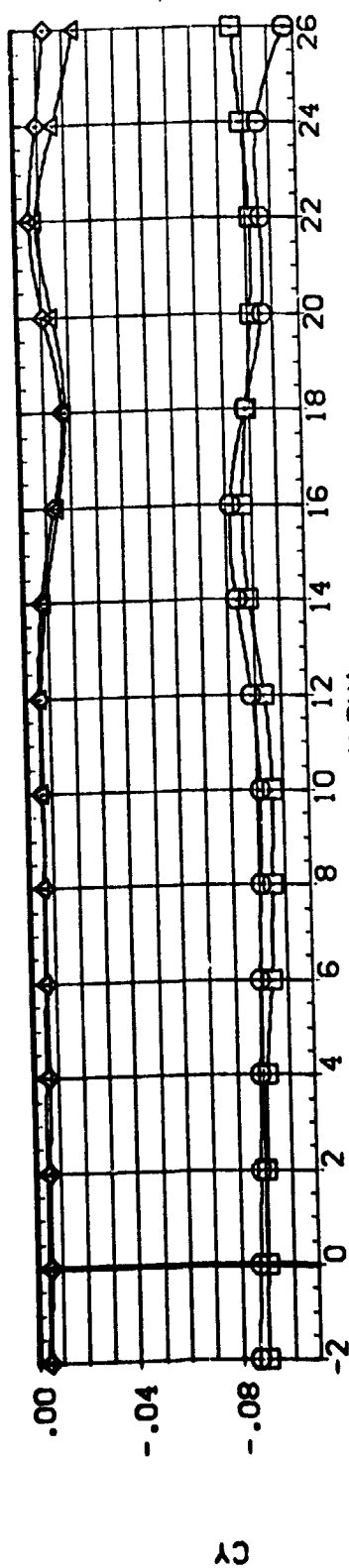


LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS

(A)RN/L = 5.40

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	FLEVTR	BOFLAP	RJOFLLR	SRF	SC IN.
[APJ011]	LA-23(LTPT-141)ARC LG-100 ORBITER (BV/VFB)	5.000	.000	-18.000	.000	49.9824	INCHES
[APJ012]	LA-23(LTPT-141)ARC LG-100 ORBITER (BV/VFB)	5.000	.000	-18.000	20.000	13.5000	INCHES
[APJ009]	LA-23(LTPT-141)ARC LG-100 ORBITER (BV/VFB)	.000	.000	-18.000	.000	10.5151	INCHES
[APJ008]	LA-23(LTPT-141)ARC LG-100 ORBITER (BV/VFB)	.000	.000	-18.000	20.000	8.9100	INCHES
						.0000	INCHES
						.0000	INCHES
						.0100	SCALE



LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS

(A)RN/L = 5.40

APPENDIX
TABULATED SOURCE DATA

Plotted data tabulations are
available on request from DMS.

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LIFT 141

PAGE 1

LA-23 (LIFT-141) LARC LO-10% ORBITER (B&WFB)

(RPUD01) (17 AUG 73)

REFERENCE DATA

SREF = 49.9424 SQ. IN. XREF = 8.9100 INCHES
 LREF = 13.9000 INCHES YREF = .0000 INCHES
 BREF = 10.5191 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .000 MACH = .166
 ELEVTR = .000 ATTORN = .000
 BCLAP = .000 RUOTLR = .000

RUN NO. 2/0 RM/L = 5.36 GRADIENT INTERVAL = -5.00/ 5.00

RM/L	ALPHA	BETA	ON	CA	CLM	CSL	CYN	CY	CPB	CPC1	CPC2
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5.357	-1.018	.01065	-.00030	.00023	-.00067	.00011	-.00009	-.00623	-.06607	-.11561	-.11580
5.368	.003	.01028	.04423	.02107	-.00996	.00012	.00006	-.00022	-.06227	-.11379	-.11622
5.374	1.125	.01075	.00944	.01976	-.01105	.00004	.00002	-.00690	-.06597	-.11654	-.11422
5.362	2.365	.01126	.14863	.01815	-.01220	-.00002	.00009	-.00004	-.09123	-.11674	-.11739
5.369	4.434	.01082	.23446	.01110	-.01441	.00001	.00016	-.00694	-.06451	-.11668	-.11636
5.400	6.826	.01175	.33631	.00032	-.01728	-.00004	.00012	-.00748	-.09933	-.12567	-.12772
5.338	8.893	.01127	.44027	.00040	-.02040	.00018	.00024	-.00766	-.09132	-.13206	-.12864
5.379	10.990	.01136	.53641	-.03271	-.02342	.00012	.00077	-.00841	-.09442	-.13530	-.13374
5.374	13.275	.00923	.64365	-.05214	-.02765	.00012	.00077	-.00813	-.09774	-.14436	-.14236
5.364	15.561	.00479	.74631	-.05516	-.03194	.00279	.00329	-.01361	-.11620	-.16037	-.15982
5.356	17.868	.01096	.82656	-.04835	-.03148	.00546	.00234	-.01605	-.12939	-.18677	-.18644
5.382	19.832	.01031	.89550	-.03821	-.03492	.00175	.00195	-.01284	-.17975	-.21515	-.22054
5.344	21.637	.00107	.93432	-.03015	-.03723	-.00367	.00166	-.00678	-.22109	-.26945	-.26396
5.377	24.035	.00639	.99187	-.02164	-.04331	.00030	.00144	-.01006	-.28206	-.34516	-.33942
	GRADIENT	.00014	.04372	-.00114	-.00103	-.00001	.00005	-.00023	.00056	-.00062	-.00063

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TABULATED SOURCE DATA, LARC LIPT 141

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LA-23(LTP"-141)LARC LO-100 ORBITER (BMLVFB)

(RPM02) (17 AUG 73)

REFERENCE DATA

SREF = 49.9024 SQ. IN. XREF = 8.9100 INCHES
 YREF = 13.9770 INCHES YREF = .0000 INCHES
 DREF = 10.3151 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .000 MACH = .167
 ELEVR = -5.000 AIRLON = .000
 BDFLAF = .000 RUFLR = .000

RUN NO. 3/ 0 RVL = 5.32 GRADIENT INTERVAL = -5.00/ 5.00

RVL	ALPHA	BETA	ON	CA	CLM	CBL	CYN	CY	CFB	CPC1	CPC2
5.355	-2.332	.01024	-.14855	.01609	.00694	.00169	.00050	-.00775	-.08421	-.10742	-.10713
5.357	-1.136	.01011	-.09106	.02076	.00717	.00164	.00052	-.00773	-.09160	-.11068	-.11178
5.358	-.104	.01079	-.04449	.02157	.00587	.00154	.00048	-.00801	-.09017	-.11197	-.11124
5.345	1.037	.00977	.00874	.02154	.00510	.00126	.00054	-.00759	-.09596	-.11032	-.11164
5.356	2.134	.01111	.03259	.02016	.00342	.00113	.00044	-.00810	-.09236	-.11705	-.11679
5.344	3.233	.01066	.09931	.01600	.00297	.00114	.00059	-.00831	-.09679	-.11663	-.11722
5.356	4.307	.01099	.14992	.01468	.00149	.00111	.00055	-.00834	-.09642	-.11621	-.11904
5.357	6.514	.01163	.24776	.00483	-.00127	.00096	.00058	-.00868	-.09642	-.11611	-.12015
5.355	8.835	.01070	.34904	-.00102	-.00435	.00093	.00077	-.00895	-.10864	-.12676	-.12699
5.361	10.984	.00963	.45193	-.02734	-.00757	.00110	.00092	-.00894	-.11034	-.13664	-.13847
5.325	13.225	.00963	.56385	-.04754	-.01214	.00128	.00117	-.00973	-.13077	-.15160	-.15354
5.341	15.402	.00999	.67676	-.06490	-.01728	.00266	.00325	-.01423	-.13377	-.17158	-.16992
5.313	17.662	.01177	.78156	-.08655	-.01791	.00529	.00309	-.01743	-.14742	-.20037	-.19879
5.306	19.849	.01463	.84953	-.09962	-.02408	.00304	.00136	-.01374	-.17323	-.22145	-.21646
5.373	21.964	.00294	.89317	-.03495	-.02687	-.00282	.00230	-.00930	-.20905	-.26006	-.25831
5.321	23.970	.00761	.95509	-.02789	-.03359	.00255	.00219	-.01206	-.25026	-.31071	-.31370
		.00012	.04397	-.00061	-.00106	-.00010	.00001	-.00010	-.00174	-.00151	-.00129

GRADIENT

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TABULATED SOURCE DATA, LARC LIPT 141

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LA-23 (LIPT-141) LARC LO-100 ORBITER (BVA/VFB)

(RP0003) (17 AUG 73)

REFERENCE DATA

SREF = 49.9624 SQ. IN. XREF = 8.9100 INCHES
 LIREF = 13.9720 INCHES YREF = .0000 INCHES
 BREF = 10.3191 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

BETA = .0000 MACH = .166
 ELEVTR = -10.0000 AILRON = .0000
 BDFLAP = .0000 RUOFLR = .0000

PARAMETRIC DATA

RUN NO. 4/0 RWL = 5.36 GRADIENT INTERVAL = -5.00/ 5.00

RWL	ALPHA	BETA	ON	CA	CLN	CBL	CYN	CY	CPB	CPC1	CPC2
5.366	-2.412	.01021	-.24177	.02244	-.02622	-.00100	-.00031	-.00440	-.09568	-.10362	-.10462
5.379	-1.820	.01027	-.16926	.02492	.02423	-.00062	-.00041	-.00472	-.09912	-.11055	-.10960
5.367	-.124	.00963	-.13799	.02630	.02293	-.00054	-.00032	-.00467	-.10327	-.11266	-.11264
5.373	1.090	.01015	-.06614	.02634	.02112	-.00023	-.00021	-.00532	-.10114	-.11236	-.11209
5.367	2.116	.01047	.03666	.02503	.01979	-.00022	-.00017	-.00564	-.10180	-.11303	-.11233
5.361	3.269	.01128	.01164	.02281	.01838	-.00014	-.00006	-.00651	-.09996	-.11420	-.11236
5.370	4.284	.01109	.05649	.02003	.01706	.00000	-.00003	-.00654	-.11225	-.12196	-.11923
5.340	6.430	.01039	.14815	.01281	.01536	.00011	.00013	-.00666	-.11268	-.12630	-.12531
5.349	8.662	.01079	.24062	.00022	.01279	.00009	.00017	-.00705	-.11794	-.13694	-.13293
5.370	10.909	.01156	.34933	-.01756	.00959	.00032	.00020	-.00760	-.13102	-.14314	-.14185
5.366	13.114	.00976	.44729	-.03634	.00822	.00063	.00040	-.00718	-.14823	-.15667	-.15546
5.370	15.300	.00957	.57116	-.04904	.00705	.00055	.00157	-.01094	-.14815	-.16884	-.16856
5.361	17.626	.01003	.67399	-.04800	-.00325	.00289	.00218	-.01321	-.15411	-.18075	-.18074
5.322	19.706	.01292	.75796	-.04112	-.00855	.00374	.00147	-.01294	-.15947	-.21030	-.21038
5.327	21.600	.00322	.61820	-.03676	-.01378	-.00246	.00182	-.00796	-.18804	-.23677	-.23781
5.360	23.962	.00278	.69764	-.03159	-.02197	-.00134	.00211	-.00862	-.21768	-.26476	-.26515
	GRADIENT	.00016	.04479	-.00039	-.00135	.00015	.00007	-.00035	-.00151	-.00178	-.00157

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MODULATED SOURCE DATA, LARC LTPPT 141

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LA-23(LTPPT-141) LARC LO-11 ORBITER (BMTVFB)

(RP0004) (17 AUG 73)

REFERENCE DATA

9007 = 49.9024 90.1M. XMRP = 6.9100 INCHES
LNEY = 13.2070 INCHES YMRP = .0000 INCHES
9008 = 10.5151 INCHES ZMRP = .0000 INCHES
SCALE = .0100 SCALE

BETA = .0000 MACH = .167
ELEVTR = -15.0000 AIRCON = .0000
BDFLAP = .0000 RUOFLR = .0000

PARAMETRIC DATA

RUN NO. 5/0 RVL = 5.32 GRADIENT INTERVAL = -5. 5.00

RVL	ALPHA	BETA	ON	CA	CLM	COL	CYN	CY	CPB	CPC1	CPC2
9.351	-2.979	.00721	-35406	.03439	.04536	.00305	.00014	- .1475	-1.10640	-1.11500	-1.11496
9.368	-1.273	.00663	-30323	.03777	.04357	.00309	.00036	-1.00510	-1.11367	-1.12240	-1.12149
9.346	-1.172	.00686	-24993	.03669	.04179	.00333	.00030	-1.00972	-1.11993	-1.12448	-1.12374
9.399	.094	.00754	-20134	.03939	.04018	.00356	.00051	-1.01613	-1.12409	-1.12493	-1.12339
9.354	2.024	.00731	-15155	.03696	.03857	.00333	.00055	-1.00612	-1.12223	-1.12852	-1.12649
9.361	3.098	.00844	-09918	.03746	.03852	.00308	.00049	-1.00680	-1.12695	-1.13323	-1.13417
9.390	4.189	.00620	-04098	.03517	.03502	.00295	.00046	-1.00627	-1.12731	-1.12661	-1.12726
9.347	6.375	.00922	.04033	.02754	.03163	.00281	.00041	-1.00687	-1.14525	-1.14495	-1.14297
9.359	8.656	.00940	.15155	.01495	.02901	.00290	.00040	-1.00697	-1.15982	-1.16431	-1.16308
9.345	10.620	.01244	.25268	.00108	.02543	.00431	.00044	-1.00897	-1.16385	-1.17009	-1.17026
9.346	13.056	.01378	.35497	-01770	.02218	.00477	.00051	-1.01010	-1.16713	-1.17755	-1.17644
9.342	15.282	.01153	.46447	-03234	.01694	.00382	.00113	-1.00000	-1.16252	-1.17953	-1.18042
9.331	17.497	.01376	.57953	-03101	.01276	.00407	.00121	-1.01250	-1.16653	-1.20107	-1.20250
9.341	19.656	.01828	.66101	-03015	.00561	.00638	.00076	-1.01396	-1.19378	-1.22765	-1.22841
9.337	21.795	.00979	.73557	-02964	.00031	.00170	.00161	-1.01144	-1.18565	-1.25052	-1.24984
9.328	23.975	.00870	.81249	-02926	-00703	.00140	.00184	-1.01160	-1.22628	-1.28082	-1.27543
9.322	26.022	.01748	.86592	-01484	-01258	.00272	-00046	-1.01001	-1.27127	-1.32325	-1.32398
		.00020	.04577	.00007	-01156	-00001	.00004	-1.00026	-1.00295	-1.00214	-1.00210

GRADIENT

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TABULATED SOURCE DATA, LARC LIFT-141

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LA-23 (LIFT-141) LARC LO-100 ORBITER (RM/VFB)

(RPUD33) (17 AUG 73)

REFERENCE DATA

REF = 49.9884 26.1N. 100P = 0.9101 INCHES
LIFT = 13.9000 INCHES 100P = .0000 INCHES
REF = 10.5131 INCHES 200P = .0000 INCHES
SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .000 MACH = .168
ELEVTR = -15.000 AIRCON = .000
BOFLAP = -18.000 RUOFLR = .000

RUN NO. 7/0 RM/L = 5.35 GRADIENT INTERVAL = -5.00/ 5.00

RM/L	ALPHA	BETA	ON	CA	CLM	COL	CYN	CY	CPB	CPC1	CPC2
5.360	-8.571	.00802	-39485	.02945	.03427	.00187	-.00099	-.00360	-.00984	-.02873	-.01743
5.352	-1.339	.00804	-33683	.03806	.03203	.00206	-.00040	-.00401	-.01927	-.03849	-.02621
5.342	-.288	.00910	-29132	.03406	.03036	.00230	-.00034	-.00431	-.01814	-.02990	-.03342
.000	.080	.00019	16807	.06877	-.03257	.00010	-.00751	.00181	.00000	.04326	.00000
5.371	.833	.00792	-24187	.03433	.04669	.00235	-.00017	-.00418	-.01753	-.03936	-.02991
5.379	1.958	.00797	-19033	.03369	.04724	.00261	-.00002	-.00462	-.01521	-.02700	-.03506
5.373	3.056	.00956	-14022	.03219	.04486	.00243	-.00001	-.00567	-.02459	-.03961	-.03721
5.353	4.115	.00828	-.08229	.02985	.04383	.00256	.00011	-.00595	-.02748	-.03821	-.03972
5.349	6.339	.00919	.00966	.02196	.04075	.00253	.00032	-.00650	-.02951	-.04749	-.04472
5.414	8.578	.00873	11040	.00932	.03618	.00238	.00046	-.00665	-.03220	-.03609	-.04844
5.391	10.773	.00847	20997	-.00566	.03582	.00243	.00049	-.00667	-.03178	-.03968	-.06780
5.365	12.945	.00776	30037	-.02365	.03325	.00245	.00076	-.00720	-.04552	-.07188	-.06734
5.351	15.136	.00772	41531	-.04076	.02811	.00169	.00136	-.00985	-.03957	-.07178	-.07479
5.359	17.353	.00839	53003	-.04366	.02336	.00316	.00178	-.01098	-.05473	-.08089	-.08233
5.370	19.565	.01420	62037	-.03960	.01641	.00333	.00097	-.01214	-.10315	-.10493	-.10577
5.357	21.724	.00532	70060	-.03783	.01033	.00156	.00171	-.01593	-.14936	-.12384	-.14182
5.352	23.781	.00342	78841	-.03036	.00200	.00103	.00170	-.00773	-.19980	-.18487	-.18165
GRADIENT		.02018	.00677	-.02065	.00700	.00716	.00024	-.00746	-.00229	-.00261	-.00347

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TABULATED SOURCE DATA, LARC LPT 143

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LA-23 (LPTT-141) LARC LO-100 ORBITER ORBIT

(RPUD06) (17 AUG 73)

REFERENCE DATA

BMD7 = 49.9024 IN. INCH = 0.9100 INCHES
 LMD7 = 13.5000 INCHES INCH = 0.0000 INCHES
 BMD7 = 10.5131 INCHES INCH = 0.0000 INCHES
 SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .000 MACH = .107
 ELEVIR = -15.000 AIRRON = .000
 BDFLAP = -10.000 RUDFLR = 20.000

RUN NO. 0/0 RM/L = 5.39 GRADIENT INTERVAL = -5.00/ 5.00

RM/L	ALPHA	BETA	CA	CLM	COL	CYN	CY	CPB	CPC1	CPC2
5.390	-2.634	.00490	.06161	.06343	.00122	.00007	-.00314	-.20130	-.12437	-.18039
5.400	-1.403	.00336	.06494	.06172	.00163	-.00001	-.00309	-.19334	-.11726	-.14752
5.405	-.343	.00454	.06701	.05967	.00171	.00018	-.00329	-.20046	-.14282	-.18160
5.376	.006	.00309	.06746	.05731	.00187	.00022	-.00376	-.20552	-.13026	-.16636
5.374	1.000	.00442	.06971	.06070	.00200	.00032	-.00366	-.18994	-.16522	-.14820
5.349	2.998	.00326	.06591	.05402	.00207	.00030	-.00414	-.21222	-.14010	-.16493
5.344	4.095	.00361	.06283	.05279	.00195	.00024	-.00423	-.20221	-.15328	-.19462
5.367	6.281	.00414	.05534	.04991	.00182	.00033	-.00475	-.21281	-.14671	-.17750
5.370	8.513	.00672	.04331	.04746	.00165	.00034	-.00514	-.17464	-.18888	-.19321
5.396	10.896	.00651	.02775	.04497	.00156	.00056	-.00574	-.20171	-.15974	-.18166
5.393	12.001	.00575	.02946	.04179	.00180	.00099	-.00670	-.16744	-.20753	-.23335
5.376	15.125	.00506	.00761	.03654	.00195	.00200	-.00961	-.20777	-.22906	-.18669
5.349	17.383	.00628	-.01067	.03090	.00227	.00264	-.01252	-.29382	-.26217	-.27913
5.346	19.356	.00079	.00633	.02479	.00434	.00246	-.01483	-.29017	-.31768	-.29782
5.384	21.669	.00510	-.00645	.01715	.00265	.00293	-.01273	-.22017	-.38642	-.33417
5.392	23.894	.00532	.00767	.02014	.00265	.00261	-.01187	-.20693	-.33799	-.32584
	GRADIENT	.00726	.00266	-.00161	.00011	.00234	-.00019	-.00096	-.00489	-.00263

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TABULATED SOURCE DATA, LARC LTPT 141

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LA-23(LTPT-141)LARC LO-100 ORBITER (BLA/FB)

(RPUD07) (17 AUG 73)

REF/ENCE DATA

BREF = 49.9404 IN. INCH = 0.9150 INCHES
 LREF = 13.9000 INCHES INCH = .0000 INCHES
 BREF = 10.9191 INCHES INCH = .0000 INCHES
 SCALE = .0100 SCALE

BETA = .000 MACH = .160
 ELEVTR = -10.000 ALTCON = .000
 BDFLAP = -10.000 RUOFLR = 20.000

PARAMETRIC DATA

RUN NO. 9/ 0 RM/L = 3.35 GRADIENT INTERVAL = -5.00/ 5.00

RM/L	ALPHA	BETA	ON	CA	CLM	CEL	CYN	CY	CPB	CPC1	CPC2
9.374	-2.487	.00444	-.30315	.03379	.04362	.02872	-.00159	-.00011	-.21092	-.16474	-.17487
9.377	-1.334	.00791	-.27197	.05619	.04193	.02874	-.00136	-.00015	-.23149	-.13480	-.19486
9.366	-.100	.00870	-.21906	.05735	.04012	-.00221	-.00180	-.00127	-.22376	-.14226	-.19662
9.374	.833	.00823	-.17353	.05793	.03647	-.00208	-.00110	-.00192	-.22620	-.14894	-.19207
9.364	1.909	.00959	-.12179	.05704	.03682	-.00197	-.00097	-.00236	-.24301	-.16755	-.20175
9.376	3.102	.00950	-.07024	.05553	.03900	-.00164	-.00071	-.00273	-.23016	-.16937	-.20907
9.369	4.181	.00912	-.02313	.05233	.03421	-.00163	-.00064	-.00337	-.23234	-.15732	-.17665
9.364	6.470	.00906	.07860	.04353	.03180	-.00155	-.00051	-.00390	-.24716	-.16345	-.20113
9.356	8.602	.00728	.17165	.03192	.02931	-.00150	-.00027	-.00390	-.21769	-.14601	-.16974
9.340	10.603	.00603	.26654	.01492	.02672	-.00160	-.00021	-.00422	-.21390	-.13696	-.20235
9.344	12.992	.00721	.36636	-.00392	.01780	-.00125	.00019	-.00504	-.21304	-.16895	-.22434
9.332	15.237	.00835	.49106	-.01934	.01722	-.00120	.00073	-.00629	-.20380	-.19663	-.25112
9.344	17.449	.00794	.60801	-.01927	.01216	.00025	.00060	-.00782	-.21113	-.20963	-.31272
9.296	19.684	.01009	.69758	-.01435	.00692	.00143	.00094	-.01005	-.20687	-.29198	-.28272
9.349	21.789	.00476	.79424	-.01446	.00054	-.00060	.00199	-.00946	-.26470	-.33217	-.33268
9.349	23.935	.00644	.87143	-.01331	-.00670	.00022	.00235	-.01177	-.36061	-.27643	-.34993
GRADIENT	.00010	.04516	-.00017	-.00017	-.00146	.00015	.00014	-.00052	-.00257	-.00143	-.00131

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TABULATED SOURCE DATA, LARC LTPT 141

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LA-23 BLTPT-141 LARC LO-100 ORBITER (BLU-WFB)

(RPUR700) (17 AUG 73)

REFERENCE DATA

SCD7 = 49.8004 IN. IN. 12MP = 0.9100 INCHES
 LAD7 = 13.9000 INCHES 12MP = .0000 INCHES
 BCD7 = 10.9191 INCHES 12MP = .0000 INCHES
 SCALE = .0100 SCALE

BETA = .000 MACH = .166
 ELEVTR = .000 ALLRON = .000
 BCDPLAP = -18.000 RUOFLA = 20.000

PARAMETRIC DATA

RUN NO. 10/ 0 RM/L = 5.36 GRADIENT INTERVAL = -5.00/ 5.00

RM/L	ALPHA	BETA	ON	CA	CLM	COL	CYN	CY	CXB	CPC1	CPC2
5.357	-2.241	.00000	-1.0000	.05127	.00513	-.00124	-.00004	-.00003	-.28070	-.10794	-.21007
5.366	-1.074	.00003	-.06006	.05317	.00393	-.00130	.00013	-.00411	-.29360	-.19718	-.25427
5.363	-.090	.00732	-.01034	.05371	.00232	-.00123	.00005	-.00432	-.28294	-.20069	-.24109
5.360	1.205	.00003	.00907	.05314	.00147	-.00137	.00006	-.00426	-.24220	-.18924	-.23900
5.366	2.203	.00002	.00230	.05145	.00227	-.00137	.00006	-.00413	-.26124	-.18010	-.24024
5.355	3.347	.00714	.13300	.04928	-.00004	-.00146	.00003	-.00446	-.23414	-.18043	-.21722
5.367	4.464	.00760	.17912	.04537	-.00211	-.00151	.00013	-.00313	-.29637	-.21461	-.22555
5.360	6.011	.00070	.27763	.03500	-.00409	-.00157	.00018	-.00345	-.26131	-.20796	-.22690
5.360	6.667	.00072	.37162	.02071	-.00734	-.00167	.00023	-.00601	-.26136	-.21131	-.23036
5.362	11.082	.00773	.46046	.00160	-.01033	-.00127	.00040	-.00612	-.22907	-.22135	-.24765
5.364	13.340	.00051	.50774	-.01009	-.01403	-.00209	.00106	-.00749	-.19052	-.21054	-.27503
5.366	15.325	.00367	.70303	-.02019	-.01933	-.00371	.00330	-.01306	-.24633	-.29131	-.21066
5.363	17.728	.00035	.78371	-.01930	-.01901	.00410	.00309	-.01778	-.31076	-.32265	-.34107
5.366	19.601	.00916	.84734	-.01110	-.02122	.00169	.00269	-.01449	-.27066	-.29277	-.34520
5.366	21.972	.00248	.91167	-.00715	-.02565	-.00294	.00214	-.00951	-.35077	-.35939	-.32411
5.366	24.146	.00023	1.00139	-.00336	-.03234	.00135	.00344	-.01649	-.42599	-.38279	-.34179
5.366	GRADIENT	.00015	.04293	-.00006	-.03107	-.00004	.00001	-.00013	.00109	-.00324	.00169

LA-23 (LPT-141) LARC L-100 ORBITER (B41VFB)

(RPL009) (17 AUG 73)

REFERENCE DATA

SREF = 49.9824 SQ. IN. XMRP = 8.9150 INCHES
 LREF = 13.5000 INCHES YMRP = .0000 INCHES
 BREF = 17.3131 INCHES ZMRP = .0000 INCHES
 SCALE = .0100 SCALE

BETA = .000 MACH = .167
 ELEVTR = .000 AIRCRN = .000
 BDFLAP = -18.000 RUFLR = .000

PARAMETRIC DATA

RUN NO. 12/ 0 RNVL = 5.38 GRADIENT INTERVAL = -5.00/ 5.00

RNVL	ALPHA	BETA	ON	CA	CLN	COL	CYN	CV	CPB	CPC1	CPC2
5.378	-2.171	.00946	-.07549	.01689	-.00109	-.00057	-.00022	-.00494	-.00060	-.06874	-.03621
5.391	-1.003	.00974	-.02282	.01859	-.00233	-.00021	-.00017	-.00324	-.06417	-.06368	-.05981
5.422	.043	.01015	.01970	.01871	-.00373	-.00009	-.00015	-.00349	-.06681	-.07195	-.05935
5.414	1.186	.01077	.06898	.01784	-.00482	-.00014	-.00007	-.00612	-.06966	-.07233	-.06161
5.403	2.289	.00966	.11374	.01683	-.00582	-.00015	-.00008	-.00360	-.07172	-.05970	-.07399
5.379	3.403	.01099	.16589	.01493	-.00728	.00003	-.00013	-.00616	-.06158	-.06921	-.07474
5.374	4.532	.01162	.21424	.01037	-.00873	.00003	-.00023	-.00622	-.06141	-.06960	-.07754
5.381	6.725	.01183	.31273	.00701	-.01153	.00028	-.00029	-.00617	-.06671	-.07435	-.08356
5.362	8.676	.01146	.41086	-.01498	-.01403	.00042	-.00031	-.00591	-.06209	-.08456	-.07160
5.400	11.135	.01087	.51376	-.03407	-.01684	.00071	-.00028	-.00564	-.07408	-.07744	-.07137
5.382	13.315	.00919	.61751	-.05593	-.02065	.00084	.00018	-.00620	-.08000	-.08295	-.07617
5.367	15.560	.00538	.79537	-.05844	-.02528	.00236	.00250	-.01144	-.09098	-.09326	-.08717
5.387	17.710	.01183	.90380	-.05132	-.02360	.00631	.00297	-.01699	-.11460	-.12435	-.12501
5.407	19.876	.01173	.98386	-.03831	-.02758	.02851	.00111	-.01888	-.17342	-.17379	-.17149
5.390	21.896	.00087	.90587	-.03067	-.02889	-.00330	.00162	-.00382	-.24299	-.21771	-.22898
5.376	24.087	.00439	.97582	-.02408	-.03615	-.02065	.00196	-.00919	-.26782	-.27407	-.26812
	GRADIENT	.00028	.04299	-.00093	-.00112	.00005	.00000	-.00019	-.00328	.00015	-.00348

LA-23 (LIFT-141) LARC LO-100 ORBITER (BHVFB)

(RPUD10) (17 AUG 73)

REFERENCE DATA

SREF = 49.9824 SQ. IN. XMRP = 8.9100 INCHES
LREF = 13.9700 INCHES YMRP = .0000 INCHES
BREF = 10.5131 INCHES ZMRP = .0000 INCHES
SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .0000 MACH = .167
ELEVTR = .0000 ALLRON = .0000
BSFLAP = -16.0000 RUFLR = 40.0000

RUN NO. 13/ D RV/L = 5.47 GRADIENT INTERVAL = -5.00/ 5.00

RV/L	ALPHA	BETA	CN	CA	CLM	CBL	CYN	CY	CPB	CPC1	CPC2
5.399	-2.248	.00927	-19400	.10878	.02696	-.00023	-.00231	.07259	-.51815	-.32321	-.34395
5.353	-1.129	.00953	-13912	.11098	.02500	-.00015	-.00243	.07216	-.45681	-.30073	-.36221
5.407	-.089	.01005	-.09344	.11082	.02343	-.00016	-.00246	.07205	-.50053	-.33954	-.35006
5.371	1.134	.00983	-.04333	.11106	.02219	-.00033	-.00245	.07221	-.50670	-.31269	-.35515
5.369	2.251	.00923	.00780	.11079	.02119	-.00042	-.00248	.07256	-.51863	-.32292	-.34505
5.417	3.302	.00981	.05139	.10866	.02006	-.00052	-.00247	.07226	-.47945	-.35673	-.33530
5.383	4.390	.01030	.10086	.10663	.01885	-.00052	-.00256	.07213	-.51434	-.33579	-.34346
5.349	6.955	.00985	.19334	.09731	.01612	-.00048	-.00254	.07228	-.48426	-.30368	-.38331
5.332	8.632	.01001	.29871	.08361	.01271	-.00036	-.00276	.07282	-.44806	-.36796	-.37899
5.366	11.054	.00971	.38937	.06324	.00871	.00007	-.00269	.07287	-.42318	-.34674	-.39184
5.409	13.253	.00919	.50361	.04363	.00524	.00063	-.00181	.07034	-.37183	-.40090	-.37980
5.366	15.443	.00478	.61349	.03174	-.00108	.00074	.00067	-.51012	-.38949	-.41808	-.36274
5.416	17.674	.00790	.72461	.03159	-.00381	.00375	.00139	-.00936	-.49599	-.36236	-.35718
5.379	19.607	.00979	.80155	.03422	-.00543	.00357	.00098	-.00930	-.59807	-.42907	-.42655
5.447	22.027	.00999	.89645	.03281	-.01052	.00223	.00067	-.00836	-.69163	-.48901	-.48926
5.467	24.307	.01485	1.02094	.02743	-.01565	.00459	-.00016	-.00871	-.79424	-.53431	-.52525
GRADIENT		.05009	.04393	-.00034	-.00117	-.00006	-.00001	-.00002	-.00169	-.00421	.00195

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LTPT 141

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LA-23 (LTPT-141) LARC LO-100 ORBITER (BWT VFB)

(RPUD11) (20 SEP 73)

REFERENCE DATA

SREF = 49.9824 SQ. IN. XMRP = 8.9100 INCHES
LREF = 13.5000 INCHES YMRP = .0000 INCHES
BREF = 10.5191 INCHES ZMRP = .0000 INCHES
SCALE = .0100 SCALE

BETA = 5.000 MACH = .184
ELEVTR = .000 AILRON = .000
BDFLAP = -18.000 RUCLR = .000

PARAMETRIC DATA

RUN NO. 14/ 0 RNVL = 4.86 GRADIENT INTERVAL = -5.00/ 5.00

RNVL	ALPHA	BETA	ON	CA	CLM	CBL	CYN	CY	CFB	CFC1	CPC2
4.879	-2.190	5.10306	-.07347	.01200	-.00176	-.00293	.00672	-.08592	-.03271	-.06018	-.03356
4.892	.138	5.10705	.02859	.01336	-.00438	-.00474	.00698	-.08706	-.06798	-.06749	-.06613
4.879	1.129	5.10771	.07035	.01411	-.00527	-.00546	.00702	-.08715	-.03562	-.06377	-.03808
4.865	2.299	5.10638	.12097	.01180	-.00827	-.00852	.00708	-.08823	-.08942	-.06277	-.09956
4.878	3.345	5.10385	.16630	.00923	-.00778	-.00696	.00713	-.08880	-.06312	-.06853	-.06241
4.886	4.493	5.09826	.21559	.00650	-.00688	-.00754	.00730	-.08884	-.06784	-.06603	-.09969
4.846	6.658	5.08182	.31463	-.00472	-.01143	-.00877	.00748	-.08958	-.06808	-.06276	-.06922
4.827	8.904	5.05946	.41528	-.01918	-.01451	-.01011	.00779	-.09086	-.07581	-.07253	-.07536
4.865	11.232	5.03253	.52427	-.03746	-.01830	-.01173	.00737	-.08985	-.07735	-.08005	-.08240
4.867	13.440	5.00344	.63870	-.05115	-.02392	-.01167	.00748	-.08437	-.08452	-.08106	-.07999
4.918	15.750	4.96590	.75037	-.05925	-.02739	-.01219	.00595	-.08137	-.11393	-.11121	-.10558
4.928	17.678	4.91991	.81025	-.05154	-.02716	-.01090	.00605	-.07532	-.14428	-.13556	-.12782
4.892	19.901	4.86697	.85572	-.03666	-.02725	-.00808	.00800	-.09532	-.21039	-.19252	-.18827
4.880	22.030	4.81154	.94581	-.03712	-.03221	-.00818	.00725	-.09528	-.24761	-.22813	-.21502
GRADIENT		-.02072	.04321	-.00090	-.00106	-.00070	.00008	-.00046	-.00186	-.00079	-.00068

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TABULATED SOURCE DATA, LARC LTPT 141

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LA-23 (LTPT-141) LARC LO-100 ORBITER (BLAVFB)

(RPUD12) (20 SEP 73)

REFERENCE DATA

REF = 49.5624 IN. XREF = 0.9100 INCHES
 LREF = 13.9200 INCHES YREF = .0000 INCHES
 BREF = 10.5136 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = 5.0000 MACH = .204
 ELEVTR = .0000 AILRON = .000
 BDFLAP = -16.0000 RUCFLR = 20.000

RUN NO. 15/ 0 RW/L = 4.44 GRADIENT INTERVAL = -5.00/ 5.00

RW/L	ALPHA	BETA	ON	CA	CLN	COL	CYN	CY	CPB	CPC1	CPC2
4.420	-2.211	5.10302	-1.1216	.03031	.00509	-.00163	.00601	-.09024	-.26277	-.29454	-.23692
4.413	-1.093	5.10313	-.06060	.03166	.00429	-.00226	.00603	-.08670	-.24772	-.26228	-.22206
4.402	.006	5.10761	-.01362	.03182	.00266	-.00321	.00609	-.09010	-.23754	-.30262	-.22699
4.490	1.123	5.10665	.03491	.03227	.00211	-.00405	.00616	-.09103	-.25091	-.28095	-.21981
4.405	2.173	5.10371	.07617	.03053	.00066	-.00477	.00614	-.09049	-.25506	-.26254	-.21316
4.412	3.317	5.09970	.12766	.04658	-.00263	-.00532	.00630	-.09063	-.26928	-.30401	-.22712
4.430	4.511	5.09544	.17976	.04435	-.00182	-.00593	.00636	-.09187	-.22894	-.31345	-.23062
4.437	6.756	5.06233	.28466	.03311	-.00458	-.00716	.00900	-.09463	-.32041	-.28397	-.21671
4.460	8.849	5.06147	.37253	.02708	-.00747	-.00823	.00941	-.09511	-.35340	-.28816	-.23584
4.435	11.030	5.05484	.46148	.00469	-.01115	-.00917	.00915	-.09522	-.36411	-.28421	-.23569
4.370	13.291	5.00013	.60181	-.01054	-.01698	-.00938	.00680	-.08959	-.36991	-.29574	-.24740
4.406	15.305	4.96049	.69765	-.01306	-.02028	-.01060	.00594	-.08611	-.37250	-.28913	-.25075
4.409	17.692	4.91077	.77796	-.01133	-.02704	-.00998	.00719	-.08786	-.41029	-.30585	-.28859
4.426	19.933	4.85655	.86669	-.00739	-.02234	-.01062	.00801	-.09065	-.45543	-.35222	-.30148
4.367	22.016	4.80447	.94353	-.00573	-.02636	-.00968	.00714	-.09126	-.52169	-.37052	-.31940
4.439	24.162	4.75100	1.00347	.00311	-.03136	-.00803	.00465	-.08829	-.52941	-.38739	-.35121
	GRADIENT	-.00116	.04316	-.00062	-.00114	-.00066	.00007	-.00029	-.00137	-.00327	.00093

GOVERNMENT FIELD PRINTING PLANT
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 NALC-MICROD ASSEMBLY FACILITY 1973
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